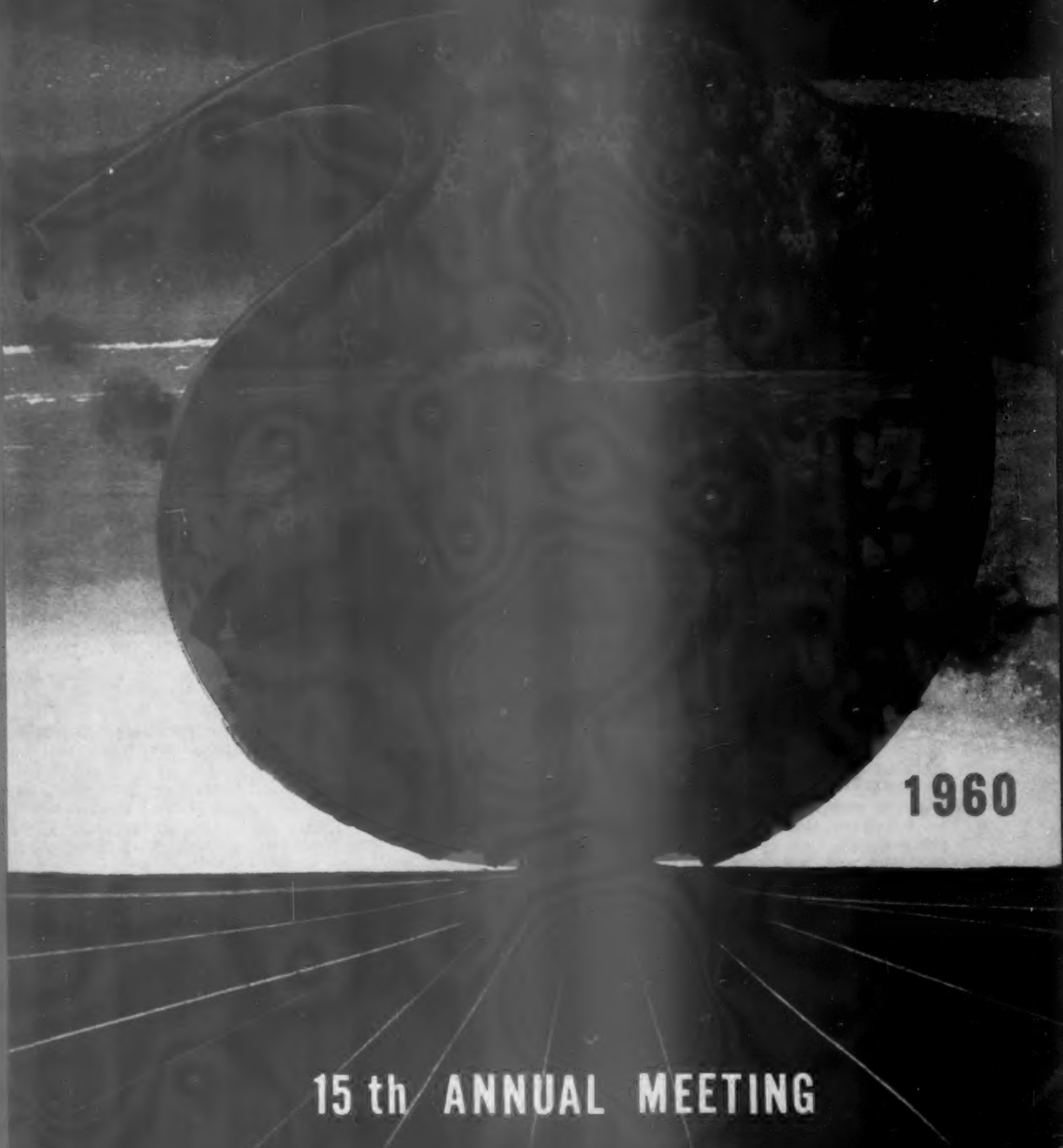
# ARMED FORCES CHEMICAL JOURNAL

AMERICAN STRATEGIC POWER and the NEW HORIZONS for

the CHEMICAL INDUSTRY / JULY AUGUST 1960



15 th ANNUAL MEETING

# ARMED FORCES CHEMICAL ASSOCIATION


**National Headquarters**

**408-410 Park Lane Building—2025 Eye Street, N.W.**

**WASHINGTON 6, D.C.**

**(Federal 7-6823)**


The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

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*Armed Forces*
# CHEMICAL JOURNAL
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**POLICY**

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication. Such clearance does not necessarily indicate indorsement of the material for factual accuracy or opinion by the clearing agency.

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**FRONT COVER**

Mr. Charles Mendez, who recently had a successful one-man art exhibit in Washington, has given us an artist's conception of what may be on the horizon for the Chemical Industry.

Timely advance information on the forthcoming 15th Annual Meeting is provided in this issue.

## INDEX



*(The September-October issue will carry a list of Chemical Corps contractors with contracts in excess of $10,000.)*

## ADVERTISERS



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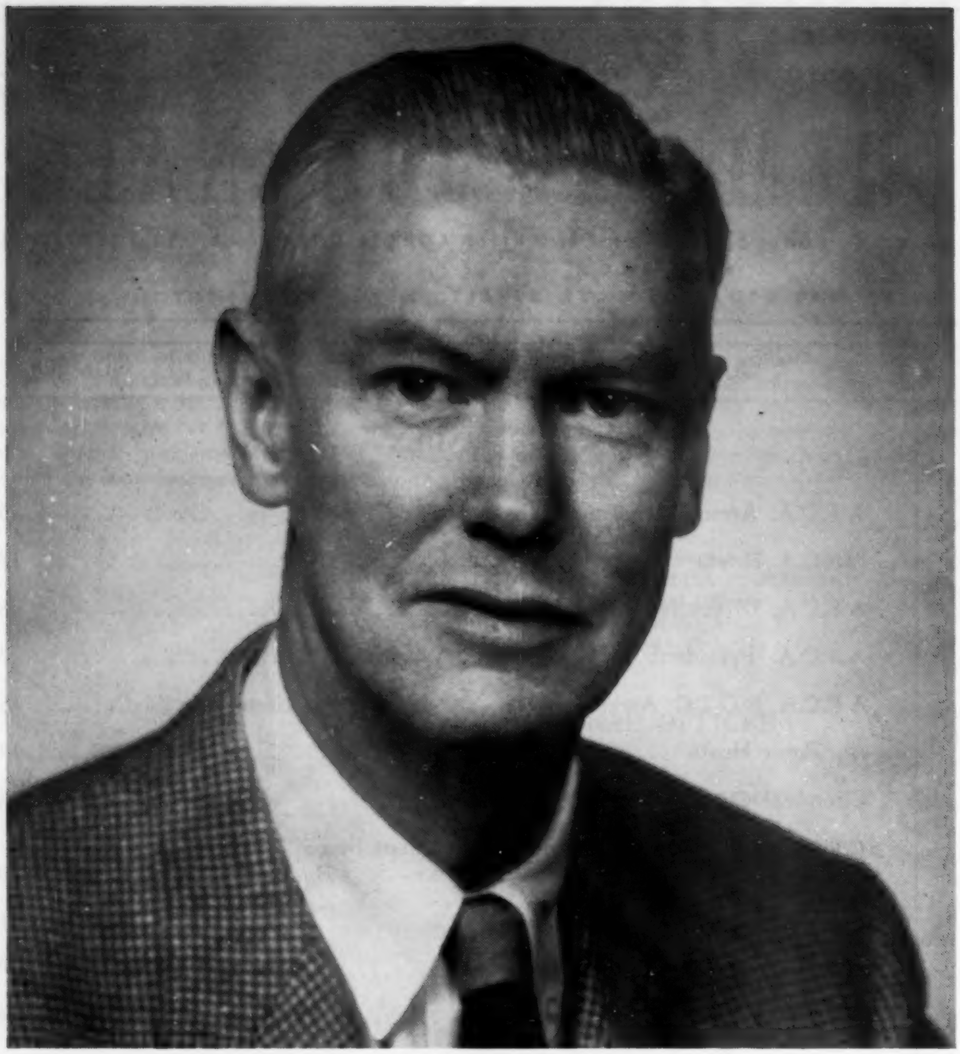


**DR. WENDELL F. JACKSON**

# A. F. C. A.'s NEW PRESIDENT

Dr. Wendell F. Jackson, newly elected President of the Armed Forces Chemical Association, is widely experienced in government-industry relationships. He is particularly familiar with pursuit of research and development problems of the Armed Forces.

Dr. Jackson has served as an advisor to Office of Scientific Research and Development of the Navy Department, he has been an observer with the Army Task Forces in Alaska, and the research director of duPont's Burnside Laboratories, specializing in propellant powders for all calibres from .45 to 16 inch.

He is now Assistant Director, Research Division, Explosives Department, E. I. duPont de Nemours & Company, Wilmington, Delaware. This department has a wide range of interest in non-explosive chemistry, but high explosive research and high energy propellant development continue to receive major attention. Recent new products are mild detonating fuse and sheet explosive; new techniques, explosive forming, hardening, powder compaction and cladding of metals.

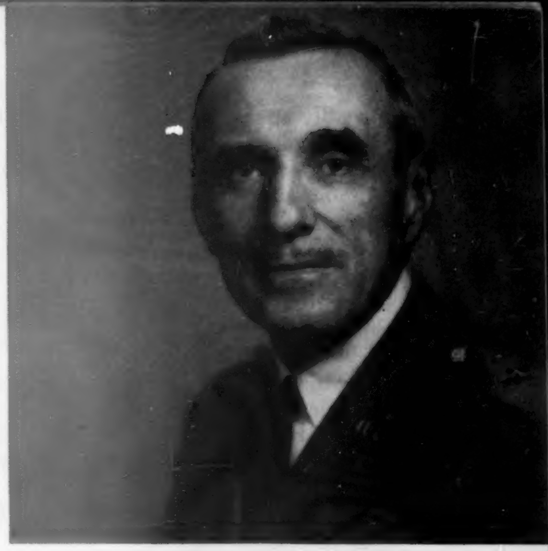
In 1958, Dr. Jackson was A.F.C.A. vice-president in charge of meetings, and made general arrangements for the Annual Meeting in Atlantic City in June of that year.

He has three degrees in chemistry from Princeton University, and studied with a postdoctoral fellowship at California Institute of Technology before he joined the duPont Company in 1935.

His home is Wilmington, Delaware.

# CHEMICAL CORPS HOLDS INDUSTRY CONFERENCES

**Replies gratifying as procedures for R&D are developed**



**BRIG. GEN. F. J. DELMORE**
**Chemical Corp. R&D Command**

More than 2,000 inquiries have resulted from the Contractors' Conference held in Washington to explain participation in the accelerated research and development program of the Chemical Corps.

One hundred ninety six industrial companies, educational institutions and scientific groups sent 334 representatives to the conference to become acquainted with some broad and basic thinking within the Chemical Corps.

Getting down to cases, the representatives were supplied a list of subjects by the Research and Development program and asked to check for future work those of interest to the company involved.

The conference was called when the Chemical Corps 1960 budget was increased for research and development from 38 million dollars to 42 million dollars.

Some phases of the conference were classified.

A partial list of subjects given to the conferees for their expression of continued interest were:

- Synthesis and Evaluation of Compounds
- Screening of Compounds
- CBR Protection for Combat Troops
- Materials, Techniques and Equipment for Air Purification
- Detection, Warning and Identification of CW Agents
- New Approaches to Toxicological Research
- BW Rapid Warning System Study and Design
- Automatic Laboratory Machinery
- Prototype BW Aerosol Sampler
- Sequential BW Sampling System
- BW Field Assessment Problems
- Gamma Scatter from a Large Area Source
- Aerosol Generator
- Automatic Sizing and County Equipment
- CW Field Assessment Problems
- Metereological Prediction and Data Systems

This conference was part of the Chemical Corps effort to acquaint American industry with research and development problems which come into being as an accelerated program in CBR planning begins to take hold. The funds which will become available for the expanded effort are earmarked for contract purposes.

The Army knows that it must be supported by the ingenuity, resourcefulness, and capabilities of industry and science to meet the requirements of national defense. The conference was but an early step in that direction.

At this time, also, a Study Requirements Program is being made available to industry. The Advanced Planning Division of the Chemical Corps Research and Development Command has devised a technique of study requirements to keep up with R&D needs.

Basic features of the study requirements are:

1. The study requirement program is a voluntary effort—not a contract effort
2. It will be used to delineate R&D problem areas which need solution for the furtherance of Chemical Corps objectives
3. Each problem or area of study will be identified as a separate requirement.
4. The Chemical Corps will provide technical guidance and assistance
5. Industry will decide which requirements it would like to investigate
6. The Chemical Corps will do its best to make industry aware of the various requirements
7. Industry participants will be required to execute a policy agreement with the Chemical Corps for each requirement selected.
8. Feasibility studies will be submitted on requirements within a date specified
9. These feasibility studies will be evaluated promptly
10. Selections will be made from these evaluations for contract funding

The study requirement is essentially a guidance document prepared by the Chemical Corps R&D Command, and it identifies a problem which needs a solution as soon as possible. Each requirement will individually describe:

a. Technical problem in a particular area and performance objectives fulfilled.
b. Present Chemical Corps knowledge and state of the art in terms of performance capabilities and limitations.
c. Name a coordinator, who will be currently associated with the technical details, and will assist in obtaining further technical information and assistance.

Study requirement documents will be made available to industrial and research organizations in line with their R&D interests, capabilities and security status. A composite listing of Chemical Corps Study Requirements is maintained in the R&D Command.

The policy agreement covers security measures, aspects of ownership, and requires a report on the practicability of combining scientific advances, theories and techniques for the solution of the problem.

Broadly speaking, the principal interests are:
- Biological Agents
- Laboratory and Field Test Science
- Chemical Agents
- Flame Agents
- Incendiaries
- Protective Equipment
- Screening Agents
- Smokes
- Weapons and Munitions
- Investigation of Chemical and Medical Properties of Toxic Compounds
- Munitions Engineering
- Processing and Production of Chemical Materials
- Air Sampling
- Investigations of Biological and Medical Properties of Infectious Agents
- Processing and Production of Biological Materials
- Cloud Physics
- Ecology and Epidemiology
- Electronics and Instrumentation

The list of companies and representatives at this conference follows:

## LIST OF ATTENDANCE

ABBOTT LABORATORIES
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A. O. SMITH CORP
Milwaukee, Wisconsin
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AERO-JET GENERAL CORP.
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Newport Beach, Calif.
Leland I. Coontz

AIR REDUCTION COMPANY
Murray Hill, N.J.
Thomas H. Manninen

AIRCRAFT ARMAMENTS, INC.
Cockeysville, Maryland
Louis F. Doty
Robert L. Zouck

ALLEGANY INSTRUMENT CO., INC.
Cumberland, Maryland
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Frank Porter

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Boston 15, Mass.
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AMCEL PROPULSION, INC.
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AMERICAN AIR FILTER CO., INC.
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George E. Thompson

AMERICAN BIO-CHEMICAL LABS, INC.
Baltimore 28, Maryland
Samuel L. Goldheim
E. R. Gerberg

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Hempstead, N.Y.
Ernest A. Goetz

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(Pearl River, N.Y.) (Lederle Labs)
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Louis M. Weiner
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APPLIED SCIENCE, INC.
Bethesda 14, Maryland
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ARMOUR & COMPANY
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Jules D. Porsche

ARMOUR RESEARCH FOUNDATION OF ILLINOIS INST. OF TECHNOLOGY
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Morris Fischer
Francois J. Olmer

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ARTISAN METAL PRODUCTS, INC.
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James Donovan

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Cincinnati, Ohio
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Ralph K. Jones
J. W. Saylor

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Brecksville, Ohio
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BAIRD-ATOMIC, INC
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Richard Frank Wood

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Garson A. Lutz

BECKMAN INSTRUMENTS, INC.
Fullerton, Calif.
Leland G. Cole
John F. Crowe
Carl Neisser
Kenneth G. Halvorsen

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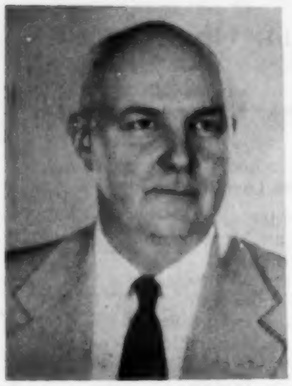
# AIR FORCE PLANS WIDE PROGRAM AS ANNUAL MEETING TAKES SHAPE

## Topic: American Strategic Power and the New Horizons For the Chemical Industry



**RAdmr M. P. Hottel**
**USN Ret.**
National Lead Co.
Chairman
General Committee

**Mr. L. D. Weiford**
Stauffer Chemical Co.
Chairman
Programs Committee

**Mr. C. W. Hayes**
Celanese Corp. of America
Chairman
Arrangements Committee

The 15th Annual Meeting is earmarked for success. Secretary of Defense Thomas S. Gates, Jr., has designated the Air Force as host service for the two day session with the members of the Armed Forces Chemical Association.

Preliminary meetings of the four Armed Services have been held to outline the subjects which the military will present at the meeting.

Although the following subjects have been assigned to the services, there are more topics than time may allow and if this proves to be true, then, one or two subjects will be dropped when final arrangements are made.

Air Force topics include: Chemistry in the Air Force, USAF Missiles, Procurement of Air Materiel, and SAC.

Navy subjects include: The Navy Missile Program, and Chemicals in the Bureau of Ships.

Marines have been assigned: The Marine Corps Defense Board.

Army topics are: Army Missiles, CBR, STRAC, and Army Chemicals in Industry.

The Department of Defense is scheduled to present: the Organization of Space Efforts, the Soviet Challenge, USSR and NATO.

The Atomic Energy Commission has the subject: Clean Weapons.

Before the program is formally adopted, the Secretary of Air Force will invite the Secretaries of the other services to participate.

The various topics of interest for the meeting to be held in the Sheraton-Park Hotel in Washintgon, D.C., September 15 and 16, were originally outlined, very broadly speaking, when Rear Admiral M. P. Hottel, USN Retired, chairman for the 15th Meeting, met with his committee and members of the Armed Forces to initiate guide lines for the program.

A.F.C.A. Committee members at the meeting included: L. D. Weiford, Stauffer Chemical Co.; C. W. Hayes, Celanese Corp.; Dr. G. P. Vincent, Olin Mathieson Chemical Corp.; S. A. Mattison, Hooker Chemical Corp., and Marvin Marcus, Lummus Company.

Lieut. Colonel J. A. McWhirter, USAF, represented the Deputy Chief of Air Force for Development at this gathering. Colonel McWhirter is on duty in Washington with the Director of Research and Development, Policy and Programs, of the Air Force. It is this office that is making the actual arrangements within the military establishment.

On the social side, black tie will be proper for the banquet. The Air Force "Strolling Strings" are being sought for entertainment at this dinner.

The invitation list includes the subscribers of the Armed Forces Chemical Journal, and special invitation is also given to those chemical companies and corporations who had personnel attending the April meetings with the Chemical Corps on research and development.

The meeting itself comes at a time when the Army

*(Continued on page 36)*

**Dr. G. P. Vincent**
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The Lummus Company
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# FORCES CHEMICAL ASSOCIATION 1961

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**Deputy Commanding Officer**
**U.S. Army Chemical Corps Training Command**
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**Experiment Station**
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**Menlo Park, Calif.**

# CHEMICAL CORPS EXPANDS RESEARCH AND DEVELOPMENT

**Program to move steadily upward with the aid of industry and science**

***By* DALLAS C. HALVERSTADT**

EXPENDITURES for the Chemical Corps research and development porgram may triple in size during the next five years.

The research and development expenditures in the field of chemical and biological weapons is expected to progressively increase annually to a level of at least three-fold compared with the $46 million for F.Y. 1960, according to competent military observers.

The proposed program represents, of course, military thinking on requirements necessary to strengthen capabilities to meet CBR attack. This is an exercise of planning rather than an anticipation of appropriations.

Industry, universities, and scientific groups will probably be asked to put the bulk of these increased dollars to work.

Specifically, and in consonance with a directive of General Arthur G. Trudeau, Chief of Army Research and Development, 90 per cent of the dollars over the 1960 level go to industry, private laboratories, and institutions.

"What we are trying to do is to exploit the scientific ability within industry and the educational institutions of the United States and the free world to see how far we can go using the mechanism of contracts," General Marshall Stubbs, Chief Chemical Officer of the Army, told the House Subcommittee on Appropriations while testifying on the 1961 budget.

Plans call for 1965 expenditure to be reached in easy steps rather than in one big jump. For example, a $46 million budget in F.Y. 1960 (since 1 April 1960) will be replaced by $54 million budget in 1961.

According to congressional testimony, percentage of the budget dollars to be spent with industry and other scientific sources outside the government would increase gradually. For example, it is estimated as 18 per cent of the 1960 budget, 33 per cent of the 1961 budget, 39 per cent of the 1962 budget, and possibly 55 to 60 per cent beyond 1962.

This expanded planning is to program defense measures as well as provide offensive capabilities. Some of the items of primary interest at the present time are (1) an improved alarm for rapid warning of chemical agents, (2) vaccines for defense against BW agents, (3) adequate nerve gas treatment.

These measures along with the whole R&D effort are to give us a good, strong, adequate military program, Dr. William H. Summerson, Deputy Commander for Scientific Activities, Research and Development Command, Army Chemical Corps, told the Congressional Committee.

Soviet chemical warfare capabilities are pointedly illustrated by General Trudeau's statement that the Russian divisions on the Western front are equipped with one-sixth of their attack potential in chemicals. This includes one-sixth of Soviet combat ammunition with trained experienced troops in the field.

The Defense Science Board issued a report a little less than a year ago which pointed out the inadequacies of our defense posture in the chemical and biological fields and recommended immediate action for increased research and development in both these fields.

Mention should be made, too, of the American Chemical Society Committee on Civil Defense and their recent report on CBR defense. This report stresses the importance of furnishing information needed by the people to understand and protect themselves against chemical and biological warfare.

To fully understand present concern it is only necessary to recall the testimony last June of Major General William M. Creasy, United States Army, Retired, former Chief Chemical Officer, before the House Committee on Science and Astronautics.

"I think," he said, "that study would indicate quite clearly that the incremental cost of giving chemical or biological warheads to either your bombs or missiles would probably not exceed five per cent of the cost of the atomic system."

General Zhukov has said: "The future war, if it is unleashed, will be characterized by the mass use of air power, various types of rocket weapons and various means of mass destruction such as atomic, thermo-nuclear, chemical and bacteriological weapons."

Some of the problems in the expanded search for new and improved chemical agents can be quickly understood in light of the basic requirements which must be met before an agent can be considered suitable for military purposes:

These requirements are:
1. Biological effectiveness
2. Mass production from noncritical raw materials
3. Dissemination by feasible munitions
4. Stability in long-term storage
5. Difficulty of protection, detection, decontamination, and treatment.

In the expanding research and development program, the Army is looking for two general classes of chemical compounds. These two types are the lethal, such as nerve gases, and the incapacitating agents, which make combatants unable to fight, and from which they recover.

The incapacitating agents are grouped as psychochemicals which act on the mental processes and render an individual unfit to perform his duty, and the types which produce physical disability of temporary nature.

"It is possible to express biological effectiveness of lethal agents on a scale where the scale represents the lethal dose to man in milligrams," Dr. Summerson told the members of the Subcommittee on Appropriations.

"On one end of the scale we may place cyanide which is the least lethal of the agents we are considering," he said. "The effective dose for cyanide (intravenously) is approximately 70 milligrams per man which represents as a liquid about two small drops.

"The lethal dose (intravenously) to man of nerve gas, GB, is estimated to be one milligram which is approximately one-fiftieth of a drop. For all substances with which we are concerned, the lethal dose to man is at least 100 to 1,000 times as high as the effective incapacitating dose."

In the future of biological warfare, Dr. Robert J.

*(Continued Next Page)*

# A SOLDIER REPORTS ON LIFE IN FRANCE

Lt. Colonel Paul T. Martin, USAR, a Chemical Officer of two World Wars, is enjoying retirement in France where his paintings have been donated to churches and museums, and his collection of old French stamps on cover is considered one of the finest.

In 1935, Lt. Colonel Martin's United States stamp collection received the Grand Prize at the Philatelic Exhibition in Baltimore.

He believes that the town of Meschers, where he lives, has one of the finest restaurants outside of Paris. He writes that his cellar is well stocked, the beds in his house are soft, and Mrs. Martin is an excellent cook. This may be pertinent information to friends who wish to visit him at Villa Miramar on Boulevard de la Falaise.

Lt. Col. Martin began his World War II service in the French Foreign Legion.

He was living in France at the time on retired pay as a Warrant Officer, U.S. Army, while holding a reserve commission as Captain, Chemical Warfare Service. All funds due Americans in France at that time were frozen, and he applied for and accepted a commission as a Lieutenant in the Legion. His retired pay had been 130 dollars per month while his pay in the Legion was 90 dollars.

As a Lieutenant in the Foreign Legion in 1939, he joined the 1st Regiment and commanded the 10th Company. He fought the German from the Maginot Line to the boundary of Demarcation set up by the Franco-German Armistice. The French awarded him the Croix d'Guerre with palm and he was honorably discharged at Marseilles in 1940. He left France through Spain and returned home to go on active duty with the United States Army as a Master Sergeant until his appointment as a 1st Lieutenant in the Chemical Corps.

Lt. Colonel Martin transferred from the Chemical Corps to the Military Police in 1946 and ended his active career in 1948. The year before his retirement he sold his collection of U.S. stamps in Los Angeles for 5,000 dollars.

Now at 70 years of age, Colonel Martin has a studio in his home where he paints still life, landscapes, and, he says, last but not least, nudes. The studio is built of brick having been constructed by the 1st violin player of the French National Orchestra back in 1912. The violinist adopted brick to keep the sounds of his instrument from his wife who was habitually ill. Colonel Martin does a lot of his painting under lights at night.

His comments on the Foreign Legion are revealing. This branch of the French Military Service is, of course, fabled among the romantic and adventurous in this country. It has been the subject for Hollywood movie triumphs, paper-back books, and TV serials.

As to the Legion, Colonel Martin points out that it is undoubtedly a most unique military organization. It is not a part of the French Army, merely integrated with it. Its officers are from nearly every country in the world, sprinkled with a few officers from the regular establishment of the French Army. These regulars are generally not the ranking officers.

In Colonel Martin's battalion, the commander was a brother of the King of Denmark, a prince royal in his own right. He was killed in action at Sedan. One of Martin's Lieutenants was a Marquis de Soucre of Spain who said he had the right to wear his hat in the presence of the King.

A signature of acceptance is bonafide admittance to the Legion. Records of birth and nationality are not required. Records of a military career are germane, and Colonel Martin was closely questioned about his reserve commission in the CWS, and actual proof was submitted to a military board of six officers. This board interviews the applicant and recommends acceptance or rejection.

In summing up the merits of the Foreign Legion in 1939-40, Colonel Martin states that the average Legionnaire was handicapped with a lack of knowledge of the French language, and the restricted issue of munitions for training purposes. For example, at that time, a Legionnaire was issued five rounds of ball ammunition per annum for target practice. (There is undoubtedly an improvement for troops of today.)

The morale of the Legionnaire was high and his pay was good considering wage standards in Europe. Food was fair and his wine issue was abundant. The Legionnaire would sleep on the ground with one blanket in cold weather, and did not gripe.

Legionnaires were loyal to the Corps, and would fight to maintain their rights among the civil population. This soldier would kick the pants off of an Arab abusing a camel, or donkey, or a woman. These soldiers came into the Legion for adventure or from lack of civilian employment, and were not criminal types.

The NCO rated a salute, wore a gold band on his cap and was an outstanding soldier, Colonel Martin said. This NCO would make a competent combat infantry officer in any army.

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*(Continued from page 10)*

Goodlow, Director of Biological Research, Army Biological Warfare Laboratories, Chemical Corps, told a Congressional Committee that he sees the greatest threat in mutations deliberately induced by man in the laboratory.

The ability of an enemy to deliberately create new and bizarre agents of disease against which our population had no defense would constitute, in his opinion, a weapon capable of destroying us.

In discussing the effectiveness of dry biologic agents, General Stubbs estimated that 10 carriers (air or missile) distributing five tons each—or 50 tons in all—might cause casualties equal to 30 per cent of the U.S. population.

Before everybody decides this is fantastic, and the easiest way to handle the problem is to try and forget, let's remember the fact that the Russians have put some 30 million civilians through a civil defense training program.

# CHEMICAL CORPS TO PROVIDE LONG RANGE RESEARCH INFORMATION

LT. GEN. ARTHUR G. TRUDEAU
Chief, Army Research & Development

**Book to detail problem areas for science and industry; Army invites civilian aid in solutions.**

The Chemical Corps is one of the first of the Army technical services to produce a book for science and industry which outlines long range problem areas in the Research and Development program.

This book now in the draft stage is expected to be ready for printing August 1. Much of the material in the book is classified and security regulations will apply for those scientists and industrialists who will want copies.

The book may be secured from the Chemical Corps Research and Development Command, Washington 25, D.C.

All technical services of the Army are preparing similar books in their own fields of military technology.

This is a book of problems, a list of challenges in science and technology with which the Army's Research and Development Command is concerned. Lieut. General Arthur G. Trudeau, Chief of Research and Development, states in the book's foreword.

The solution of these problems, indeed, any one of them, can very substantially help this nation in its need to be as strong in the face of tomorrow's danger as it was on the battlefields of yesterday.

We are determined to stay strong by looking ahead, the foreword continues, the combined talents and resources of our country, and particularly those at the disposal of American industry, are enormous beyond telling. The contributions of industry to the nation's welfare in other moments of crisis have merited the deepest respect and gratitude of the Army. The question arises, in these perilous times—Are we not once again confronted by great danger and being drawn, unconsciously perhaps, to the vortex of the whirlpool of an uncharted area?

Quoting directly, General Trudeau said in the foreword:

"I am confident that none of our problems, given sustained attention, is impossible of solution. We are calling certain of them to your attention because I believe your organization has the ability, background and desire to help.

"Each of the Army's seven Technical Services, as well as my office, has compiled its own volume of problems comprising an eight-part series that are being made available to interested organizations. I have felt, since becoming Chief of Research and Development, an increased need for a clear and concise statement of the Army's needs. Many industrial leaders have asked for such a guide to our problems, reflecting their own desire to be of help.

"To keep these challenges in proper perspective—to emphasize only those problems that still are wide open to research—we have for the most part excluded problems currently under government sponsorship, either by industry or the Army. A few of the problems may already be funded, but if they are listed here, it is because anticipated results are not likely to give us all the answers we need. Finally, we have excluded development or applied problems requiring only product configuration, and "systems" problems that are likely to be beyond the realistic capability of individual firms.

"What we are looking for are scientific and technical wonders—major and minor. The Army is aware that such advances, and the efforts to bring them about, consume an industry's financial and human resources. The Army itself is concerned that successful research, of ultimate practical application, should not go unrewarded, within the framework of existing budgeting and contracting procedure. You may be assured, therefore, that this volume is placed in your hands with this realistic outlook."

Major General Marshall Stubbs, Chief Chemical Officer, writes the introduction to the book, and he states:

"The Chemical Corps is using the medium of this problem guide to delineate many of the research and development problems which, if resolved, would further the state-of-the-art in chemical and biological warfare.

"It is the sincere belief of the Chemical Corps that we must enlist the full support of the scientific and technical talent of the United States to provide the industrial "know-how" which will contribute substantially to the military's offensive and defensive capability in chemical and biological warfare. We urgently need new ideas and fresh concepts which can advance our thinking and capability to meet our military goals.

"Many of our problems are unique and without precedent. In addition they are diverse in scope and involve technical problems whose solutions must necessarily be based upon industrial ingenuity and the rapidly expanding potentials of modern technology. To bridge the gap between the Chemical Corps, faced with these problems, and industry, which has the capability and willingness to resolve these problems, this problem guide has been prepared and distributed to organizations who may be able to contribute to our research and development effort.

"The Chemical Corps welcomes your suggestions and recommendations toward the solution of these problems and will further cooperate with and assist interested organizations."

Brigadier General F. J. Delmore has published instructions on how to make use of the book.

The R&D Command maintains two research and de-

*(Continued on page 29)*

# A. F. C. A. AFFAIRS

## ACTING EDITOR APPOINTED

I am pleased to announce the appointment by the Executive Committee of Dallas C. Halverstadt, of Silver Spring, Maryland, as Acting Editor of the ARMED FORCES CHEMICAL JOURNAL, effective with this issue of the magazine.

Mr. Halverstadt, who served as an officer in the Army in World War II, is a former newspaper man and is now employed in the Department of Defense in the Office of Information and Education.

CLIFFORD L. SAYRE, President

## ★ BE IT RESOLVED— ★

WHEREAS, Colonel John C. MacArthur has served as Editor of the Armed Forces Chemical Journal since 1953 and has so improved and fashioned it that it effectively functions to develop a proper Armed Forces and Chemical Industry relationship, thereby aiding the Association to achieve, in part, its mission, and

WHEREAS, Colonel MacArthur has brought to this task from his long and outstanding military career a patience, skill and understanding which the editing of a technical journal demands, and

WHEREAS, he has shown poise and dignity and an exceptional ability to evaluate the situations faced, bringing great credit to the Association by the leadership with which he has guided this publication, and

WHEREAS he has made known his desire to retire from this position,

NOW BE IT RESOLVED That the Executive Committee of the Armed Forces Chemical Association, regretting the decision of Colonel John C. MacArthur to retire but understanding and appreciating the basis and spirit on which it was made, desires to express its heartfelt thanks for the excellence in skill and soundness in judgment shown by the Editor and,

BE IT FURTHER RESOLVED That the Committee, as a mark of its indebtedness and esteem, includes this Resolution in the minutes of this meeting and cause it to be shown to the membership of the Association by its publication in THE JOURNAL.

## Medical Men Hear Plea

MIAMI BEACH—The importance of widespread civilian and military training in the care of persons subjected to nerve gas "cannot be over-emphasized," Dr. Van M. Sim, of the U.S. Army Chemical Center in Maryland, told the American Medical Association at its meeting here recently.

"The need for active training and public information programs is vital to our national preparedness," he said.

What makes the need for general understanding and know-how so urgent? Dr. Sim said it is because nerve gas casualties are mass casualties, and require immediate treatment.

"There is no time—as in a wound of the leg or an accident resulting in fractures—to bind our wounds, relieve the pain and transport us to a hospital," the U.S. Army Chemical Warfare Laboratories scientist said.

In military terms, he observed, there is no other situation where the "buddy system" is more important to the combat soldier.

Treatment measures have been developed by scientists studying the actions and effects of the nerve gas compounds and their chemical cousins among the insecticides.

Treatment of the nerve gas casualty, Dr. Sim said, includes the use of atropine sulfate, respiratory resuscitation and oximes.

Atropine is the standard drug for the nerve gas casualty, he said, and has provided "reliable and predictable results" in severe cases. It is administered by injection.

The primary cause of death among nerve gas casualties is due to the inability of the respiratory muscles to function, scientists have determined. Therefore, Dr. Sim said, the victim must be assisted in his breathing until the administered drugs allow a degree of respiratory recovery. Rescue breathing—the mouth-to-mouth and mouth-to-nose methods—is satisfactory for maintaining the individual casualty, he noted. For contaminated atmospheres, a mask-to-mask device has been developed and is undergoing refinement.

A third therapeutic "partner" is the use of oximes, the drugs most recently added to the "medicine chest" for the nerve gas casualty. Dr. Sim pointed out that the oximes presently are useful only as adjuncts to atropine and resuscitation. The oximes appear to shorten the recovery time, he said.

**Major General Barksdale Hamlett, Assistant Deputy Chief of Staff for Military Operations, spoke to the New York Chapter of A.F.C.A. on the "Berlin Situation." He contrasted the situation in East and West Berlin in a talk illustrated by 21 slides. A question and answer period followed.**

**Mr. Stanley W. Schmitt, Dupont technical representative, addresses Chesapeake Chapter A.F.C.A. in Baltimore on subject of newly developed synthetic rubbers.**

# UNITED STATES AIR FORCE

## HEADQUARTERS, WASHINGTON, D. C.

**With the U. S. Air Force in the role of host service this year for the annual meeting of A.F.C.A., special interest for our members attaches to personalities of the Air Force High Command. Herewith pictures and brief biographical sketches of the Secretary and the Chief of Staff.**

### THE SECRETARY

THE Hon. Dudley C. Sharp, Secretary of the Air Force, was appointed on December 11, 1959, having until then served as Under Secretary since August 3, 1959.

Mr. Sharp, born in Houston, Texas, March 19, 1905, was graduated from Princeton with a BS degree in 1928. He then joined the Mission Manufacturing Company of Houston, makers of equipment for the petroleum industry, as vice president; was made executive vice president in 1935, and president in 1946.

During World War II (1942-45), he served in the Navy in various capacities, including assignments as Executive Officer and Commanding officer, on anti-submarine vessels; and later, he served on procurement duty in the Navy Department. Early in 1945 he became Administrative Manager of the Applied Physics Laboratory, Silver Spring, Maryland.

As Under Secretary of the Air Force, Mr. Sharp served as Chairman of the Air Force Requirements Review Board and Defense Department representative on the Department of Defense Federal Aviation Agency Advisory Committee.

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GENERAL Thomas D. White was appointed Chief of Staff of the United States Air Force on July 1, 1957, having previously served with the 4-star rank of a full general as Vice Chief of Staff since June 30, 1953.

Born in Walker, Minnesota, August 6, 1901, General White was graduated from West Point in 1920, commissioned in the Infantry and served four years on regimental and student duty in that branch.

He began flying training in 1924 and served since September 1925 in the Army Air Corps and later the U.S. Air Force, on a variety of assignments, including: Chinese language student in Peking, China; Assistant Military Attache for Air to Russia; Assistant M.A. for Air to Italy and Greece, with station in Rome; student, Air Corps Tactical School, Maxwell Field, Alabama; student, Command and General Staff School, Fort Leavenworth, Kansas, and duty as Military Attache to Brazil, followed by various Air staff or command positions.

During World War II General White served in the Southwest Pacific, participating in the New Guinea, Southern Philippines and Borneo campaigns. In 1946 he assumed command of the Seventh Air Force, and was stationed in Okinawa and in Hawaii. Later he was appointed Chief of Staff of the Pacific Air Command with station in Tokyo and, in October 1947, he took command of the Fifth Air Force in Japan. General White transferred to duty in the Office of the Secretary of the Air Force in 1948, and became Deputy Chief of Staff, Operations, of the Air Force in 1951.

### THE CHIEF OF STAFF

## MOON VEHICLES SUBJECT OF STUDY

Aspects of moon surface locomotion, new vehicle concepts, and aircraft landing mechanisms which could operate without landing strips are among the subjects to be discussed at the First International Conference on the Mechanics of Soil-Vehicle Systems.

Because of the Army's long interest in "off-the-road mobility," the Office of Ordnance Research, Duke University, is a joint sponsor of this conference along with the Italian Army, the Turin Institute of Technology and the Italian Research Council.

The conference is scheduled for Turin in 1961. Details of the program are to be released in February 1961. Those interested in attending or submitting papers should contact Headquarters U.S. Army Ordnance Tank-Automotive Command, 1501 Beard, Detroit, Michigan.

## COLONEL TAYLOR COMMANDS OFFICE OF ORDNANCE RESEARCH

Colonel George Wellford Taylor has assumed command of the Office of Ordnance Research, U.S. Army, which has been located ever since its inception in 1951 on the Duke University campus in Durham, North Carolina.

Colonel Taylor received his M.A. and Ph.D. degrees at Princeton University, and was a National Research Fellow at Princeton. He is also a graduate of the Army Command and Staff College (1945) and the Army War College (1953).

The new OOR commander is married to the former Carola Fox Whitman, of Boston, Massachusetts, an alumna of Radcliffe College. The Taylors have two sons, George Jr., and Carter W. The family will make their home at 1025 Dacian Avenue, Durham.

## CWS HISTORY ON SALE BY A.F.C.A.

Arrangements have been made with the Government Printing Office whereby the volume of the Army official histories, "U.S. Army in World War II, The Technical Services, The Chemical Warfare Service: Organizing For War," by Dr. Leo P. Brophy and Col. George J. B. Fisher, may be procured through the Armed Forces Chemical Association. The price of this volume is $4.00.

Orders placed with the Association will be handled without delay. They should be directed to:

The Secretary-Treasurer
Armed Forces Chemical Association
Suite 408 Park Lane Building
2025 Eye Street, N.W.
Washington 6, D.C.

All checks should be made payable to the Armed Forces Chemical Association.

O. E. ROBERTS, JR.
*Secretary-Treasurer*

# 41 OUTSTANDING ROTC CADETS

A.F.C.A's Medal awards to outstanding R.O.T.C. cadets specializing in chemistry or allied sciences, were made this year at each of 41 selected colleges and universities throughout the nation enrolled in the program.

The selected students—one at each institution which participated—included 32 Army, 4 Navy and 5 Air Force R.O.T.C. cadets.

Special effort was made this year by A.F.C.A. Headquarters to arrange for the presentation of each award, which consists of a military-type bronze medal and accompanying scroll, by a member of the A.F.C.A. chapter in whose area the institution concerned was located. In many cases this was done. Where this was not feasible the presentation was made by the Professor of Military Science and Tactics or other official of the institution concerned. In one instance, the presentation was made by the Governor of the State in which the college or university is located.

Recommendations for the award are based both upon R.O.T.C. and academic standing of the student. Winners may be selected from either the junior or the senior classes.

Presented herewith are photos of this year's winners, with the names and colleges or universities attended.

## ARMY

**WILLIAM F. ABERCROMBIE, JR.**
**Georgia Institute of Technology**

**EDWARD J. BANE**
**South Dakota School of Mines and Technology**

**GEORGE GORDON BLANKFARD, JR.**
**North Carolina State College of A&E**

**JERALD ALLEN BLUMBERG**
**Michigan College of Mining and Technology**

**JOHN O. CRONK**
**Iowa State University**

**JOHN WM. DONALDSON**
**Missouri School of Mines and Metallurgy**

**JAMES CARR EAGLE, JR.**
**Wake Forest College**

**JOHN R. FICENEC**
**Saint John's University**

**THOMAS LEE GUTSHALL**
**University of Delaware**

**RONALD DAVID HARRIS**
**The Ohio State University**

**DONALD R. HARTTER**
**University of Illinois**

**FRANCIS S. KOWALCZYK**
**Saint Peter's College**

# RECEIVE AFCA's 1960 AWARDS

**GALE ARTHUR LEITER**
**Western Michigan University**

**ALAN D. LIND**
**Idaho State College**

**GERALD RALPH LOWDER**
**Agricultural & Mechanical College of Texas**

**DOUGLAS B. OSTIEN**
**Michigan State University**

**RICHARD JOSEPH OZGA**
**De Paul University**

**RICHARD G. RHOADES**
**Rensselaer Polytechnic Institute**

**ALAN W. RICE**
**Carnegie Institute of Technology**

**JOHN PRESTON SANDERS**
**Knox College**

**DOUGLAS A. SCHERRER**
**Ohio University**

**GEORGE ARTHUR SCHNABEL**
**Massachusetts Institute of Technology**

**CARROLL THOMAS SCIANCE**
**University of Oklahoma**

**TRENTON J. SPOLAR**
**University of Notre Dame**

**DOUGLAS L. SPOONER**
**University of Cincinnati**

**ANDRIS A. STAKLIS**
**The University of Nebraska**

**JOHN ANTHONY STITZELL**
**State University of Iowa**

**ELWOOD PASCHALL STROUPE**
**Rose Polytechnic Institute**

# R. O. T. C. WINNERS OF A. F. C. A. AWARDS

**ROBERT W. WARING, JR.**
**Cornell University**

**NEAL OTTWAY WELLER, JR.**
**Mississippi State University**

**CARL O. YORIMOTO**
**University of Colorado**

**ROBERT LAVERNE YOXTHEIMER**
**Bucknell University**

**NAVY**

**BEVERLY BROWN FUQUA**
**Vanderbilt University**

**GERALD THOMAS MAGEE**
**University of Missouri**

**TED WILLIAM MARTENS**
**University of Wisconsin**

**STEWART E. REUTER**
**Columbia College**
**(Columbia University)**

**AIR FORCE**

**CALVARD S. ALLEN**
**Brigham Young University**

**JOHN FREDERICK ALTENBURG**
**North Dakota Agricultural College**

**ANTHONY J. GALLO**
**Purdue University**

**JAROLD ALAN MEYER**
**California Institute of Technology**

**FRANK E. RIZZO**
**University of Detroit**

## HAZARDS OF WORKING WITH NEW CHEMICALS UNDERGO HEALTH STUDIES

The Army Chemical Center will serve as primary agent for toxocological research in the Department of Defense with the research being consolidated under the general direction of the Advanced Research Projects Agency.

Dr. Herbert F. York, Director of Defense Research and Engineering, announced that work will be done under ARPA direction with the advice and assistance of the National Academy of Sciences, National Research Council Advisory Center of Toxicology, and the Office of Science, Department of Defense Research and Engineering.

The ARPA program on toxicological research concerns new chemical products which may be incidentally a hazard to health under anticipated working conditions.

Chemical warfare agents are specifically excluded from the studies. The separate military departments will continue to be responsible for determining the environmental and occupational health hazards peculiar to their specific activities.

## INVENTORS COUNCIL SEEKS NEW CHEMICAL PRODUCTS

The National Inventors Council is seeking help for the design of 60 new devices needed by the Armed Forces.

One of the problems in chemistry is the demand for fuel cell material with enough structural strength so that large discs or rectangular plaques formed of it will be self supporting. Another obstacle to be hurdled in chemistry is the need for a material to bond thermoelectric materials at temperatures up to 1,000 C. Also needed is a dry lubricant, stable over a temperature range from 65 to 1,200°F.

Metallurgical difficulties include the search for a protective coating for stainless steel at temperatures above 2,000°F, and a titanium coating to safeguard copper screens submerged in liquid ammonia solutions.

Food technologists are concerned with the change in protein structure in some foods as a result of dehydration. Some means is needed to make dehydrated high-protein foods more structurally stable when water is added.

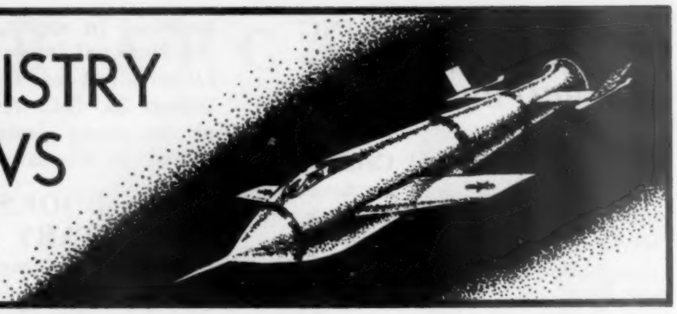
Any inventor who can come up with a solution to one of the problems outlined should describe his proposal in writing and send it to the *National Inventors Council*, U.S. Department of Commerce, Washington 25, D.C. A complete list of all 60 items desired may be obtained at the same address.

## BOOKS FOR MILITARY READING

*Prepared and issued by the Department of Defense*

Panzer Leader, *Guderian*
Combat Actions in Korea, *Gugelér*
Atomic Weapons and Armies, *Miksche*
Military Heritage of America, *Dupuy*
Command Decisions, *Greenfield*
West Point Atlas of American Wars, *Esposito*
Rockets, Missiles and Space Travel, *Ley*
Guided Missiles in War and Peace, *Parsons*
Developments in Military Technology and Their Impact on U.S. Strategy and Foreign Policy, *Johns Hopkins University*
Century of Total War, *Aron*
Arms and Men, *Millis*
Psychological Warfare, *Linberger*
Principles of International Politics, *Lerche*
Military Policy and National Security, *Kaufman*
Strategy in the Missile Age, *Brodie*
Limited War, *Osgood*
NATO and American Security, *Knorr*
The Great Army Race, *Baldwin*
The Uncertain Trumpet, *Taylor*
Soldier and the State, *Huntington*
The Direction of War, *Kingston-McCloghny*
Arms and the State, *Millis*
Government and Science, *Price*
War and Peace in the Space Age, *Gavin*
War Potential of Nations, *Knorr*
An Introduction to Economic Reasoning, *Robinson*
America as a Civilization, *Lerner*
How Russia is Ruled, *Fainsod*
Soviet Strategy in the Nuclear Age, *Garthoff*
Soviet Image of Future War, *Garthoff*
Inside Russia Today, *Gunther*
What We Must Know About Communism, *Overstreet*
Protracted Conflict, *Streuz-Hupe*
U.S. Foreign Policy in the USSR and Eastern Europe, *Columbia University*
The U. S. And Africa, *Goldschmidt*
The Middle East in World Affairs, *Lonczowski*
Image of America, *Bruckberger*
National Strategy in the Age of Revolution, *Huszer*
America at Mid-Century Series — *by the Rockefeller Brothers Fund*
Draper Committee Report

# DEFENSE CHEMISTRY IN THE NEWS



*WILLIAM T. READ, SR.*

*This Department consists of condensations of news releases and of articles in technical journals relating to developments in chemistry, chemical engineering, and kindred subjects, which are of definite or probable military interest. For the benefit of readers who may wish to refer to the source material upon which the paraphrased items are based, the source publications used for this review with appropriate reference numbers are listed after the last item of the text herein.*

## METALS

Introduction of 4% of raw coke-oven gas into the blast furnace is reported as having increased iron output by 12% and decreased coke consumption by a slightly higher figure. Improved stoves now permit an air-blast temperature of 1600°F. Air alone at this temperature tends to produce carbon dioxide as it burns coke immediately in front of the tuyeres. This lessens reduction, causes the formation of sticky material, and "hanging" of the furnace, with consequent disastrous "slip" of the furnace charge and discharge of ore from the top. More than the optimum 4% of the coke-oven gas consumes too much oxygen from the air and lessens the desirable formation of carbon monoxide further up in the stack. (1)

Addition of natural gas to the oxygen which is introduced through lances in open hearth operations, and the substitution of burned lime for limestone now generally used in the open hearth are said to have more than doubled output in a commercial sized furnace. (2)

Pilot plant operation of still another direct reduction process for making pig iron from ore promises to reduce investment by one half in comparison with blast furnace methods. Finely divided ore is mixed with coking coal after the fines have been preheated in a kiln to 1000-1200°F. The coal becomes plastic as it mixes with the ore. Pellets are formed in a rotary retort, and harden before discharge. With two hour retention in a reducing kiln at 1800-2000°, about 80% of the ore is reduced. Final conversion of the pellets to pig iron is accomplished in an electric furnace. (3)

Tests carried out for the Air Materiel Command on forming steel and titanium alloys by high explosives indicate that there is no evidence of increased elongations as the result of increased strain rates or pressures. Less explosive is required for forming in water than in air. Placing of a reflector over the explosive charge was found to improve results. (4)

A method of welding titanium to steel gives promise of greatly increasing the usefulness of titanium in chemical industry without the high cost of equipment of this metal. The process depends on the use of a small plug of the compatible metal, vanadium, which is placed in a hole in the steel plate and fusion-welded into this hole. Titanium sheet is put over the steel plate and a hole is drilled in to the vanadium plug. Titanium rod is then used by the same fusion-welding process to bind the sheet to the steel. The amount of vanadium used is small, and the space required for inert gas protection is restricted by a cap. Vanadium foil may be used in spot or seam welding. Only very thin layers of titanium lining are required in order to give adequate protection of steel in most chemical operations. (5)

Titanium is the metal selected for the Army's new, man-portable gun known as the Davy Crockett. It is highly resistant to corrosion and weighs about one tenth as much as the ordinary recoilless weapon. Requirements of titanium for this gun are expected to amount to 2 million pounds over the next five years, and this represents a new and significant outlet for the metal. (6)

Studies in the field of beryllium and its alloys have been carried out for the Navy and the Air Force. For the former, the subject of the research was electron bombardment melting and casting of beryllium. Compacted beryllium flakes and chips or vacuum-cast ingots were melted and cast in an electron-bombardment furnace. Smooth ingots were produced that were free of ordinary casting defects. Work for the Air Force dealt with the use of ion exchange methods in determining the makeup of alloys of beryllium containing a number of elements. Both cation and anion exchange resins permitted the determination of all elements in successive steps, using one sample portion. A comprehensive guide has also been prepared by the Air Force dealing with the toxicity of beryllium and measures for the maintenance of health among workers with this element. (7)

A beginning has been made in the new field of combining ceramic fibers with metal to make high temperature alloys. Several problems remain to be solved, but fibers are being manufactured for the process. The underlying principles are the same as those of reinforcing plastics with glass fibers. The main uses proposed are in the fields of missiles and rockets which require a strong and heat resistant alloy. Single crystals of aluminum oxide will constitute the fibers, and an alloy of 80% nickel and 20% chromium is the first metal to be used. (8)

## INORGANIC CHEMISTRY

Fused silica as an insulating material is apparently shortly to have a strong competitor in the form of a fused boron-phosphate-silicate material. The new material is said to have the low-loss electrical properties of fused silica and to be easier to fabricate in complex shapes. The high viscosity of fused silica at its melting temperature, which is also very high, limits the size and shape of articles made from it. The new ceramic is made by mixing silica and boron phosphate as fine powders, and melting at 2300°F. By pouring the melt into water, small and easily crushed nodules are

formed, which are pulverized, mixed with additives and water, and formed by conventional techniques of the ceramic industry. In the subsequent firing to 1900°F, boron phosphate crystals form within the glass. The final composition is given as 55% $SiO_2$ and 45% $BPO_4$. (9)

By employing very thin sections of lead zirconium titanate, $PbTiZrO_3$, in transistors, a very effective and relatively cheap ultrasonic cleaner has been made possible. The titanate is held between blocks of aluminum and steel. Such cleaners operate at lower frequencies, and are said to give higher cleaning speeds with less power than some of the older types. Ultrasonic cleaners undergo cavitation erosions after long usage, and in those in which the crystals are bonded directly to the housing, removal is quite difficult. The new material can be easily separated from a pitted housing. (10)

Factors controlling resistance to deformation and mechanical failure in polycrystalline (glass-free) ceramics are outlined in an Air Force report of work carried on at the National Bureau of Standards. In this research studies were made of the elastic moduli and internal friction of various oxides as a function of temperature. Typical oxides were single crystal sapphire, polycrystalline alumina with 15% lanthanum oxide, uranium dioxide, and stabilized polycrystalline zirconium. (11)

Interest in high-energy boron fuels and the competition they have met have obscured a great amount of research which is now going into boron chemistry and the many applications of this element, both civilian and military. These are some of the developments in this field. A borax-based sodium-calcium compound has proved to be very effective in protecting timber in fire-threatened areas, and it is used in controlling brush, timber, and forest fires. Herbicides which control unwanted vegetation and retard fire in remaining growth represent a rapidly growing product. Increasing amounts of gasoline additives containing boron are heavily featured by several companies. An organosodium borate is employed in hydraulic brake fluids which lowers volatility and gives corrosion protection. The isotope of boron, $B^{10}$, absorbs neutrons without emission of gamma radiation, and is increasingly used in shielding nuclear power units. Boron nitride resulting from high-pressure methods is a competitor of industrial diamonds, having a much higher oxidation temperature. Boron trichloride is joining boron trifluoride as an industrial catalyst. Boron is entering the inorganic polymer field for use in rocket devices, and shows great promise. Borax is now being produced to the extent of 1 million tons per year, and research in this field is said to amount to 83 million yearly. (12)

## ELECTRO-CHEMISTRY

Portable field radar sets for the Marine Corps and the Army are to be supplied with power from fuel cells. Units will weigh around 30 pounds and will produce 200 watts of 24-volt direct current for as much as 14 hours with a single fuel charge. These units are made up of 30 ion-membrane cells. The fuel is a metal hydride producing hydrogen, which reacts with the oxygen of the air. Containers of the hydride are sealed, and may be replaced without interruption of operation. Full load operation without maintenance is expected to be of the order of 2000 hours or longer. (13)

Use of cyanoethylated cellulose carrying phosphors and sandwiched between aluminum foil and conducting glass paper in miniature circuit assemblies for electroluminescent lamps is said to increase brightness and decrease weight. This is due to the exceptionally high dielectric constant and low dissipation factor of the acrylonitrile-treated cellulose, (14)

Laboratory results point to the possibility of lowering the cost of chlorine from diaphragm cells by the use of plantinized titanium anodes in place of the usual graphite electrodes. Overvoltage is decreased to the extent of 0.15 volts, which would mean a power saving of 100 kwh per ton of chlorine. Further power losses caused by wearing down of graphite anodes and increase of distance between cathodes and anodes would also be prevented by the substitution of the new anodes. (15)

## NUCLEAR CHEMISTRY

A new method of calcining nuclear-reactor wastes which appears to be superior to fluid bed or screw calciners involves atomizing liquid wastes at the top of an electrically heated column. This produces a fine powder at around 850°C. Original volume reduction is of the order of 3:1. Sintering of the powder to a solid brings about a total reduction of 12:1, and addition of phosphoric acid to the feed lowers the melting point and results in a 14:1 volume reduction. Sugar in the feed cuts down power requirements as the organic material reacts exothermically with the atomized particles. (16)

Contamination of the oceans by radioactive wastes is a matter of considerable international concern. The statement has been made that at present the level of contamination is well below dangerous amounts, but information is lacking as to the detailed behavior of marine environment in many respects. A ten-year program of oceanographic research is now being proposed concerning the way a contaminant is moved and dispersed by ocean currents, how plants and animals accumulate or dispose of waste of radioactive nature in such a way that the human food supply is affected, and under what conditions suspended materials and bottom deposits may change the distribution of wastes. (17)

Nuclear fuel elements consisting of "arc-fused" crystalline uranium dioxide, thorium dioxide, urania-thoria, triuranium octoxide, and uranium mono and dicarbides are now being prepared by compacting the crystalline materials inside a tube. This gives a density markedly higher than that of sintered ceramic pellets. A rotary compacting process referred to as "swaging" is also employed. There is less fuel loss in fabrication and considerably less reprocess scrap than by the older method. (18)

A new process now ready for pilot plant trials gives promise of simplifying and greatly improving the production of reactor grade uranium dioxide from the common starting substance, uranium diuranate, $(NH_4)_2U_2O_7$. It includes treatment of the diuranate with carbon dioxide to produce a uranyl carbonate intermediate, which is reacted with hydrogen and anthraquinone in the presence of a platinum catalyst. The first product is $U_3O_8$, which is converted by hydranthraquinone to the desired dioxide. Hydrogen in the presence of the catalyst makes the hydranthraquinone from the original anthraquinone, and this is regenerated in the process of the formation of uranium dioxide, and is recycled. The product is washed with acetone, and is of the proper particle size for compaction and sintering without preliminary milling. A coarser product may be made by recycling the dioxide and reacting it with the original diuranate to form a coating of $U_3O_8$, which is converted to the additional dioxide. The surface area of the dioxide product is controlled by carbon dioxide pressure. The new process is

regarded as being capable of replacing the old batch method. This requires precipitation of the diuranate with ammonia, filtration, heating to drive off ammonia, and reduction with hydrogen at a high temperature. The latter technique involves very careful control to get a material of uniform sintering properties. (19)

Free radicals reacting with oxygen to form toxic compounds constitute the major source of radiation damage to cells. Sulhydryl compounds are regarded as protective materials by reacting with the free radicals formed by radiation before they can react with oxygen. Such compounds are present in living tissue. It has been known for some time that oxygen will cause cells to be more sensitive to radiation. Evidence for the presence of free radicals includes the lowering of damage by nitric oxide, a free radical scavenger; destruction of free radicals by heat; and measurement of electron spin paramagnetic resonance of irradiated spores. Ability to form visible colonies serves as a measure of survival. (20)

## MOTOR FUELS

Introduction of magnesia into fluid cracking catalysts is said to increase yields of gasoline, propylene, and butelyene without loss of the physical properties of silica-alumina catalysts. The percentage of magnesia is small. These catalysts have lower carbon-forming tendencies, and have good regeneration properties and are resistant to heat and steam. (21)

Pretreatment of the feed to platinum-catalyst reforming operations, for the reason that this material contains such catalyst poisons as olefins, sulfur, nitrogen, and arsenic compounds, is being accomplished by a cobalt-molybdenum catalyst with an alumina base. Ammonia formed from nitrogen or its compounds attacks platinum catalyst acid sites. Sulfur affects dehydrogenation sensitivity and causes corrosion. Olefins result in heavy carbon deposition. Arsenic is a permanent poison, being removed immediately and spreading later through the system. The feed is made safe for reforming over platinum catalysts by being hydrogenated over the pretreatment catalyst containing cobalt and molybdenum. (22)

Tetramethyllead is now being added to gasoline, and may in time replace much or all of the tetraethyllead that has been standard for decades. The reason for this incipient shift lies in the changing character of motor fuels, particularly the marked increase in aromatics. In researches on the use of carboxylic acids as synergists to raise the activity of TEL, it was found that TML was more stable at the higher temperatures of the newer engines and fuels. With further increase in aromatic content of motor fuels, the advantages of TML are likely to offset the present higher cost. It has been stated on good authority that TML does not introduce air pollution nor cause a public health problem. (23)

## PLASTICS

The temperature range of crystallization of silicones is being drastically reduced by replacement of some of the methyl groups by phenyls. Other methods of producing the same general effect includes introduction of other pendant groups such as nitriles. In general copolymerization of bulky groups onto the side of the polymer chain and placing complex segments into the backbone of the polymer shifts the crystallization range by what are known as changes in "polymer architecture." Short term tests are not satisfactory in general, and the low-temperature usefulness of silicones has so far been determined by exposure tests requiring a considerable range of time and temperature. However, by assuming a Young's modulus of 10,000 p.s.i., by the standard ASTM procedure and plotting the time that is taken to reach this value as a function of exposure temperature, a graph is obtained which shows how long the elastomer is flexible for use at a given temperature. Some tests are reported as being of the order of 300 hours. (24)

By adding chloromethyl groups to aromatic rings, diphenyl oxide has been converted into products from which foams can be made that combine the heat resistance of the starting substance with the fire resistance of halogens. Almost any degree of chloromethylation has been attained. When heated with a Friedel-Crafts catalyst, the monomers polymerize to make tough, low-density foams which are expected to find use as structural materials. These foams may also be made with an inorganic filler such as glass wool or asbestos to make hard, tough boards that are both flame and chemical resistant. (25)

A water-soluble mixture of acrylamide and N,N-methylene-bis-acrylamide is now on the market as a chemical grouting agent. With catalysts such as ammonium persulfate and beta-dimmethylaminopropionitrile, this material polymerizes to a gel, which is both cross linked and bonded to soil, sand, or loose rock particles. The grouting agent and catalyst solutions are handled separately, being applied by positive displacement pumps. The time required for the materials to gel may be regulated from immediate action up to as much as one day. The gels so produced may also be modified by addition of cement, Bentonite, sawdust, dyes, salts, and thickening agents. The initial use of this acrylamide material is to prevent water seepage in the mining and construction industries, but tests have been made in over 150 field applications, particularly in sealing off underground water in a variety of excavations ranging from oil wells to open cuts. This product is stated to be an outgrowth of the U.S. Army Corps of Engineers' interest in the production of hard airstrips from sand or earth in a short time. (26)

Light scattering rather than light absorption is the basis of a new dry-process microfilm for documentation. A commercial plastic base is covered with a special, and yet not publicly announced, high polymer in which are dispersed particles of a diazo compound sensitive to ultraviolet light. The microfilm negative is placed above this special film and ultraviolet light is passed through. The sensitive compound is broken up into a residue and a gas, the amount of gas being governed by the letters or lines on the microfilm and the amount of light received. The outer layer of the exposed film containing the light-sensitive material, when heated to 255°F, softens and the gas escapes in small bubbles. These produce a pattern of crystalline material on the surface that reproduces the pattern of the negative. A short period of heating to 110°F and aging completes the process. Light which is projected through the permanent film with its surface pattern makes an image identical with the original. (27)

Use of a plastic coating applied to the outside of glassware to protect laboratory workers against flying glass in the event of breakage, explosion, or collapse of a vacuum system is reminiscent of the sandwich glass of automobile windshields and windows and of safety goggles. The plastic is also said to be resistant to most chemicals long enough to permit the recovery of the contents of a broken flask or container. (28)

A mixture of two brominated salicylanilides constitutes a powerful antiseptic that is effective against many gram-positive bacteria and also useful against some gram-negative organisms and pathogenic fungi.

*(Continued on page 26)*

# TREATMENT OF GAS CASUALTIES

*By* **Dr. Bernard P. McNamara**
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**DIGEST**

**The use of chemical warfare agents against our cities or our troops could result in sudden death of many persons and incapacitation of many others. Many aged, young, and/or infirmed persons would be left unattended. There would be a need for immediate and often prolonged medical care for the many victims by an overburdened and numerically inadequate group of medically trained persons. This staggering medical problem would be complicated by disruption through loss of personnel of the normal facilities for communication, transportation, electrification, etc. Some of the medical problems which would follow attack by chemical agents are described.**

Dr. McNamara received his undergraduate and graduate training at the University of Maryland and obtained the degree of Ph.D. in 1942 in pharmacology. He joined the staff of the Pharmacology Branch of the Chemical Warfare Laboratories in 1942. He also served a three-year tour of duty with the United States Army in these laboratories, as a toxicologist. Following discharge in 1946, he rejoined the staff of the Pharmacology Branch where his research interests included the pharmacological actions of anticholinesterases and various therapeutic agents used in the treatment of anticholinesterase poisoning. From 1954 until early in 1958 he was Chief of the Aerosol Branch, devoting his administrative and research talents to toxicological problems related to CW aerosols. His interests then centered around the effect of particle size on the inhalation and impaction of aerosols. For the last two years, he has been Chief of the Toxicology Division, comprised of Aerosol, Basic Toxicology, Field Toxicology and Gassing Branches.

Chemical warfare is toxic warfare against man. This differs from explosive warfare which destroys both man and his material possessions, such as buildings and machines. It is the intentional employment of toxic gases, liquids or solids, to produce casualties. The use of chemicals against our cities or our troops would present major medical problems.

*Casualty Producing Agents*—The casualty producing agents are divided into those which kill and those which incapacitate. A man is incapacitated when he cannot perform his duties.

## *LETHAL AGENTS*

*Nerve Gases*—The most potent lethal chemical agents known today are "Nerve Gases." These agents are stored as colorless to light brown liquids. They are odorless or faintly sweet and fruity. When they are exposed to the air they quickly vaporize. A drop of GB liquid the size of a pinhead volatilized to a gas and inhaled would be lethal. Death could result in 2 to 30 minutes. Thus, the action is so fast that there is little time for detection, protection, or treatment of poisoning. Although the main route of entry into the body is through the respiratory tract, lethal quantities can be absorbed through the eye, the skin, and the gastrointestinal tract.

*Toxicological and Pharmacological Effects of Nerve Gases*—The toxic action of nerve gases are produced either by inaction of the enzyme cholinesterase with consequent accumulation of acetylcholine at its normal sites of liberation throughout the body—or possibly by acting directly to produce acetylcholine-like effects. In either event the effects produced can be classiffed into muscarinic, nicotinic, or central, as shown in Table 1.

TABLE 1
Pharmacology of Anticholinesterase Agents

| Type of Action | Site of Action | | Response |
|---|---|---|---|
| MUSCARINIC | GLANDS | Salivary<br>Nasal<br>Bronchial<br>Gastrointestinal | Increased secretions |
| MUSCARINIC | SMOOTH MUSCLES | Bronchial | Constriction |
| | | Cardiovascular | Bradycardia, hypotension |
| | | Iris | Increased motility, Miosis |
| | | Gastrointestinal | cramps, diarrhea |
| Central | Central Nervous System | | Apprehension, hyperexcitability, weakness incoordination. collapse, convulsions, respiratory failure |
| NICOTINIC | Ganglia | | Hypertension |
| NICOTINIC | Neuromuscular Junction | | Fasciculation, paralysis |

The great toxicity and speed of action of GB would cause serious medical problems. These are:

1. The sudden production of a large number of casualties.
2. The need for immediate therapeutic measures for many casualties by an inadequate number of medical personnel.
3. The need for hours of close surveillance, continued drug therapy and continuous artificiial respiration of many casualties by inadequate numbers of medical personnel with insufficient equipment and facilities.

A better understanding and appreciation of these problems can be obtained from Figure 1 and Table 2. This table shows the percentage of a population of people (ordinate) who would be affected by inhalation of varying doses of GB (abscissa). The largest dose is 2 mg. A drop this size is smaller than the head of a pin and most persons who inhaled this quantity of GB would die in the absence of antidotal treatment. The highest dose shown could easily occur in areas close to the point of release of the agent. Progressively lower doses would result as the cloud moved downwind and diluted. Consequently, a population of individuals of varying sensitivity to the agent would be exposed to a spectrum of dosage levels.

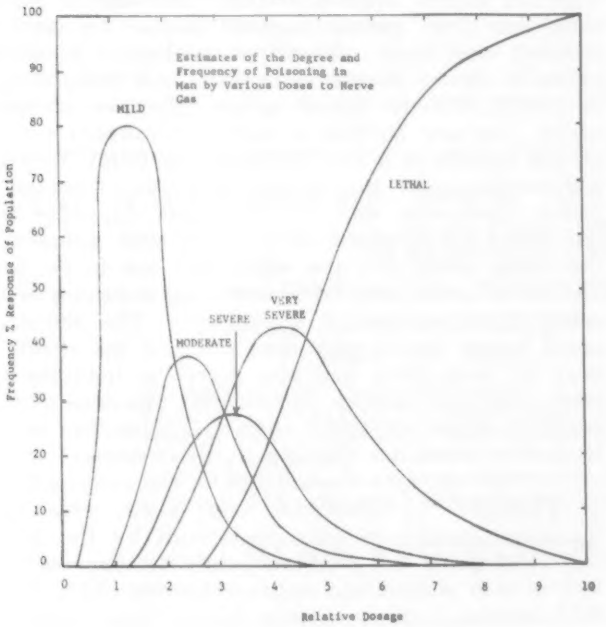
TABLE 2

*Degree of Poisoning and Toxic Signs*

| Degree | Mild | Moderate | Severe | Very Severe | Lethal |
|---|---|---|---|---|---|
| Signs | Tightness in Chest | Headache Eye pain Nausea | Tremors | Prostration | Death |
| | Miosis | Cramps | Ataxia | | |
| | Photophobia | Vomiting | Incoordination | Convulsions | |
| | Difficult Vision | Diarrhea | Weakness | | |

*The Number of Casualties*—The amount of agent delivered against us and the subsequent number of casualties cannot be predicted accurately. However, if downtown Philadelphia were the target it would be likely that more than 1000 casualties would occur within a radius of one mile of each area of release of the agent.

**Figure 1**




*Severity of Poisoning and Toxic Signs*—The number of casualties, the severity of poisoning, the signs of toxicity, and time of onset of signs depend upon the inhaled dose as shown on the abscissa of Figure 1. The various curves denote the degree of poisoning. Signs of poisoning can be ascribed to the five degrees of toxicity shown.

*Time to Death Following Inhalation of GB*—The time during which the lethal dose is inhaled influences the time to death. This is shown in Table 3. If the concentration of the agent were such that one LD50 was inhaled in 30 seconds, 10 per cent of those exposed would die in 4 minutes and 49 per cent would die in 15 minutes. If two LD50s were inhaled in 30 seconds, 10 per cent would die in 3 minutes and 95 per cent would die in 15 minutes. If one LD50 were inhaled in 10 minutes, 10 per cent and 48 per cent would die in 10 and 25 minutes, respectively. If two LD50s were inhaled in 10 minutes, 10 per cent would be dead at the end of the 10-minute exposure, and 95 per cent would be dead in 25 minutes.

TABLE 3

*The Number of Casualties and Time of Death After Exposure to Nerve Gas*

| No. of LD50s Inhaled | Exposure Time | Time to Death for Various Percentages of Exposed Population | | |
|---|---|---|---|---|
| | | 10% | 48% | 95% |
| | min | min | min | min |
| 1 | 0.5 | 4 | 15 | — |
| 2 | 0.5 | 3 | 6 | 15 |
| 1 | 10.0 | 10 | 25 | — |
| 2 | 10.0 | < 10 | 13 | 25 |

*Self Aid and Immediate Treatment*—Treatment for poisoning by nerve gas is shown in Table 4. Victims near the point of release of the agent would require immediate treatment; those at the periphery of the cloud may be responsive to therapy during the first 25 minutes after exposure. All living victims should be treated. If the lives of the exposure victims are to be saved, treatment must be initiated immediately by the victim himself or by persons close to the scene at the time of attack. The military provides for this contingency by issuing a protective mask and two atropine syrettes to each soldier. The mask is put on at once if presence of toxic agent is suspected or if any of the following effects are noted following an attack:

TABLE 4

*Treatment of Nerve Gas Poisoning*

In general, the treatment of nerve gas poisoning is as follows:

1. Begin therapy immediately
2. Terminate the exposure—mask, remove from contaminated atmosphere, decontaminate skin, remove contaminated clothing and equipment
3. Administer atropine and oximes parenterally as soon as possible and repeat as necessary
4. Resuscitate if atropine fails to restore respiration
5. Treat symptomatically, use anticonvulsants if atropine fails to control convulsions

1. A faint sweetish or fruity odor
2. A tightness in the chest
3. Difficult breathing
4. Apparent dimming of light
5. Pinpoint pupils in neighbors

*(Continued on page 30)*

## DEFENSE CHEMISTRY

*(Continued from page 22)*

Its bacteriostatic action on the skin is lowered only very slowly by repeated washings, since it appears to react with proteins on the skin surface to form insoluble compounds. It is sufficiently heat-stable to be incorporated into soaps during the crutching operation. This stability to heat up to 500°F makes use of the antiseptic possible in plastics and resins for applications in the manufacture of filaments, sheets, and fibers, giving such products immunity to bacteria and molds. (29)

### RUBBER

Rubber chemicals are being obtained from Texas lignite tar at relatively low cost, and without thermal cracking to any extent, by the use of two solvents, methanol and hexane. High boiling fractions obtained by both solvents separately and by blends of the two have proved to be good anti-oxidants for natural rubber. The fractions obtained by the two solvents differ markedly from those derived from coal tar, the tar acids being present largely in the methanol fraction, and "neutral oil," consisting mainly of paraffins, aromatics, and polar compounds containing oxygen, sulfur, and nitrogen, being found in the hexane fraction. The latter also apparently contains some phenolic compounds giving antioxidant properties as well as being softeners and plasticizers. However, the quantities required to give comparable antioxidant effects are somewhat more than twice those of compounds now on the market for this purpose. (30)

Storage under water of many materials, particularly flammable liquids and foods that need to be protected against nuclear fallout, has been proposed with the use of rubber tanks, anchored by special cradles at depths of 40 to 200 feet below the surface of the ocean. First tests are to be made in the Gulf of Mexico, off St. Petersburg, Florida. (31)

The first true fluorocarbon elastomer which shows considerable promise is made by copolymerizing trifluoronitrosmethane with tetrafluoroethylene. There are regularly recurring nitrogen-oxygen linkages in the backbone of the polymer chain, and the product is fully fluorinated and hydrogen free. It has thus high chemical and solvent resistance and serviceability to -50°F or lower. The Quartermaster Corps of the Army also considers the new fluorocarbon elastomer as showing promise not only in the elastomer field, but also as a textile treating agent. Molecular weights reach a peak at 2,000,000. Curing is spontaneous with diamines, both at room temperature and molding temperatures of 250°F. Trifluoronitrosomethane will not polymerize with itself, but will copolymerize with a great variety of unsaturated compounds. None of these products except the one just described have as yet been industrially evaluated. (32)

### ROCKET FUELS AND MATERIALS

Rocket fuels are now being successfully mixed in a continuous process that is regarded as a distinct forward step over the batch processes now limited to 3000 pounds for each operation. Casting of high-quality material is faster and safer. Mixing is done in equipment that is essentially a modified rubber extruder. The ingredients are fed to hoppers from which they pass to a screw conveyor, which brings about mixing, removal of air bubbles, and discharge into the motor casing. (33).

Substitution of dry ice, incorporated directly into solid rocket propellant mixes, for water jackets around the mixer is said to speed processing and to improve the quality of the product. The idea is now being studied by one manufacturer of rocket propellants. (34)

By increasing or decreasing nozzle throat area on demand, more versatile rocket engines have now been made possible. In the development of such engines, a starting thrust of 1000 pounds was lowered to 700 pounds and increased to 1200 pounds. The propellant used in the test firings was ammonium nitrate, but the engines may be adapted to ammonium perchlorate, which gives higher performance. Greater thrust variations may be possible with more sensitive propellants. (35)

The National Aeronautics and Space Administration's Project Echo satellite, several of which have been launched in suborbital flight, is of interest to the chemical profession both from the standpoint of construction materials and methods of inflation by subliming chemicals. The satellite is an inflatable sphere whose diameter is 100 feet, and is made of very thin polyester film which has an outside coating of vacuum deposited aluminum. It is launched in a magnesium shell, which opens at the desired velocity, and the folded balloon is inflated by the residual air in its folds. Continued inflation in space is accomplished by slow sublimation of a mixture of crystalline anthraquinone and benzoic acid. The major purpose of the space satellite is testing the bouncing of radio signals from one station to another station a great distance away. (36)

Pyrolytic graphite, which is composed of definitely aligned crystals in contrast to the random pattern of the ordinary variety, is said to have a tensile strength of 40,000 p.s.i at 5000°F and higher, as compared with less than 1000 p.s.i for tungsten at that temperature. This material has been developed mainly for use in missiles and space vehicles, as well as for such industrial uses as melting crucibles and hot pressing dies. (37)

The technique of producing a heat resistant system on the surface of space vehicles during actual flight appears to be one promising solution of this problem. The principle involved is to use thin metal coatings overa ceramic substrate. Oxidation of the metal at high temperatures, with consequent ablation, also includes the plugging of the porous ceramic surface with the molten coating. Under conditions of supersonic gas flow, porous ceramic bodies are said to transmit heat nearly as well as conducting materials, examples being magnesium oxide and molybdenum at 4500°F. Without incurring the difficulties of fabrication, the new method of surface treatment secures all the benefits of a very refractory material. To avoid the brittleness of the ceramic substrate, coatings of nickel, chromium, and iron that are extremely thin and which are removed very rapidly with diffusion of the metal oxide into the refractory, are to be used. The metal oxide boils off without any lessening of the refractory properties of the ceramic. The structural metal below the ceramic does not feel the effects of heat for some time, and also serves to hold the ceramic together. Lithium fluoride also functions in producing a dense refractory surface, and neither lowers its melting point nor destroys its effectiveness. (38)

### FOODS

Cancellation of the proposed food irradiation pilot plant, which was to have been built by the Army, may have given the chemical public the impression of lack of both civilian and military interest in the whole field. Instead, both the Atomic Energy Commission and

the Army have announced continuation of a more concentrated and highly specialized research program, each in a somewhat different fashion. The Atomic Energy program is to extend over a five year period and will probably cost about \$5 million. This program will begin with comprehensive studies of those foods which show promise of being best preserved by radiation methods, and will be confined largely to fish and fruit. Preliminary studies indicate that low-dose processing of marine products is very promising. The Army expects to spend its \$5 million over a period of six years, and will concentrate its research on such meat items as beef, pork, ham, and chicken. A radiation center is proposed, which is to be equipped with a variable voltage accelerator, a cobalt-60 source, and the necessary facilities for food preparation and for laboratory work. (39)

## CHEMICAL ENGINEERING

Natural gas which contains a very small amount of heavy hydrocarbons and at the same time is very high in carbon dioxide (over 50%) is being successfully treated by a mixture of organic esters of carbonic and primarily acetic acid. Both carbon dioxide and the high pressure solutions pass through turbines to recover most of the power originally used in the process. Reduction of carbon dioxide from a figure of 53% to 3% is reported. Water, hydrogen sulfide, and mercaptans are also removed. (40)

Gas-lubricated bearings are being manufactured and used extensively in England, particularly in nuclear power stations. Self-pressurizing gas bearings up to 8-in. diameter are employed in pumps and compressors. Equipment for circulating carbon dioxide through nuclear reactors may use this type of bearing. Since gas viscosity increases with temperature, load capacity goes up with higher temperature and shaft speed. There is also no problem of deterioration of lubricant caused by irradiation. (41)

Cooling of infrared detectors and other electronic equipment by liquid nitrogen promises to be simplified by piping the liquid distances up to 25 feet without insulating the tubing. This is said to be accomplished by handling the nitrogen as slugs of liquid, the vapor formed between the droplets function as insulation. (42)

The Navy has continued to make forward progress in the manufacture of nitroglycerine by safer methods. For some time the Naval Propellant Plant at Indian Head, Maryland, has employed a continuous nitration process. Recently this plant has installed an automatic transfer system which has eliminated need for men at four points. A sampling cup on a trolley line does away with dip sampling by an operator. A jet ejector forms a water emulsion of the nitroglycerine made in the continuous nitration unit, and lifts the material from a transfer tank to storage, which was formerly done by men who pushed what were known as "Angel Buggies." In contrast to commercial plants in which nitroglycerine is immediately stabilized for making dynamies, propellant manufacture requires a time-consuming analysis of product before storage. Ejectors also return material from catch tanks to the system, which does away with bucket transfer. Automatic controls are located 500 feet from the transfer house, interlocking devices adding to the safety of operations. A final step, on which work is being done, would be development of continuous methods of analysis. Pipelines are made of a grade of polyethylene which does not absorb nitroglycerine. (43)

Progress in the desalting program of the Office of Saline Water, Department of the Interior, was summed up in a symposium held during the 137th National Meeting of the American Chemical Society in April. By way of introduction, reference was made to the largest privately owned plant for sea water conversion, which is located on the island of Aruba in the Caribbean, which produces 2.7 million gal. of fresh water daily at a cost of \$2.00 per 1000 gal. This plant was described in this section of THE JOURNAL recently.

OSW has authorized five demonstration desalting plants, of which three will handle sea water and the other two brackish waters. Considerable research and some pilot plant operations have been carried out for the demonstration plants, but none of these plants have been erected. Only one contractor has been finally selected. Three locations have been definitely chosen, another is to be within a certain general region, but the fifth may be anywhere along the Atlantic Coast from Maine to Florida.

Of the three plants operating with sea water, one will employ 12 effect evaporation with oxygen removal from feed and use of suspended solids to treat incoming sea water. A second will be a combination of a nuclear reactor and saline water distillation. The third will employ a freezing process. The two inland brackish water plants will use electrodialysis with ion exchange membranes in one case and vapor compression and freezing in the other. These two are located in South Dakota and New Mexico. The three sea water plants will be on the Gulf Coast (Texas), and Pacific Coast (California), and somewhere on the Atlantic Coast. Cost estimates range from 60c to \$1.00 per 1000 gal. daily

*(Continued on page 29)*

# WORLD WAR II HISTORICAL PROGRAM

Of the many volumes in the official series, THE UNITED STATES ARMY IN WORLD WAR II, the three dealing with the role of the Chemical Warfare Service should prove to be of special interest to those concerned with CBR warfare today. Recent indications of an increasing awareness of the importance of CBR in strategic planning tend to emphasize the significance of a historical study of the nation's approach to such problems in the last great war.

The first volume of the three-volume series, *Organizing for War,* by Dr. Leo P. Brophy and the late Col. George J. B. Fisher, appeared off the presses last autumn and was well received. The *American Historical Review,* in its issue of April 1960, summarized a few of its high points:

> While in many respects this volume reveals the same difficulties that beset other parts of the army during the period, the growing pains of a very small organization with highly technical tasks are clearly presented. Not the least difficult problem was the question of the service's chief mission, preparation for a possibility that did not come to pass: retaliation for gas warfare initiated by the enemy. The presentation frankly shows shortcomings as well as achievements. While at times blame is placed on other organizations, the reasons for errors are always given. And there is equal frankness in assessing faults on CWS, both as a consequence of poor internal organization and as a result of personality problems. Even to those not particularly interested in this service, the volume offers interesting material on the shifts and hesitations at high military levels, the early difficulties of procurement and training, the instruction of a civilian defense personnel, misdirected effort, improved accomplishments. An otherwise dry subject is presented in an interesting style, and the material is covered thoroughly.*

Volume II of the series, *From Laboratory to Field,* by Dr. Brophy, Dr. Wyndham D. Miles, and Dr. Rexmond C. Cochrane, is scheduled for publication later this year. It covers the role of the CWS in developing, producing, and supplying to the Armed Forces the materiel of chemical warfare. In the course of this materiel effort, which began during World War I, and continued during the inter-war period and throughout World War II, the CWS achieved a substantial record of accomplishment. The volume discusses the hasty but substantial research and procurement efforts of World War I and the slow and impoverished progress of CWS development in the peacetime years as a prelude to the story in World War II. When war broke out again in Europe, America's early tentative rearmament measures enabled the CWS, for the first time in twenty years, to begin work on new installations, initiate procurement of chemical munitions, and commence the process of industrial mobilization. With the actual entrance of the United States into war, CWS activities expanded to proportions never contemplated in peacetime. An enlarged technical staff set up the first large-scale military scientific research program. Extensive work was done not only in chemical but in biological warfare as well. The development programs of the CWS resulted in the first widely successful battlefield smoke generator, portable and mechanized flame throwers, the incendiary bombs which were to do so much to destroy the power of both Germany and Japan, toxic munitions, and the most effective field protective masks available to any army.

*From Laboratory to Field* presents the story of each of the CWS's major development programs, in language meant for the layman, and turns then to discussion of a task at least as great, the problem of procuring and distributing the products of these programs in wartime quantities and under wartime conditions. It provides specific illustrations of the perplexities of a small service in obtaining contractors to produce materiel without commercial counterpart and sometimes still in process of development. The special problems involved in CWS contracting, inspection, storage, and distribution are given due attention.

The war effort of the CWS overseas is the theme of the third volume in the series, *Chemicals in Combat,* by Dr. Paul W. Pritchard, Dr. Brooks E. Kleber, and Dale Birdsell, to be published in 1961. The work begins with a study of the administration of CWS functions at theater level in Europe, the Pacific, and the Mediterranean. In each theater of operations a Chemical Warfare Service was organized, to face the tasks of setting up chemical supply to the troops, planning against the possible outbreak of gas warfare, collecting data for chemical intelligence estimates, and providing trained personnel for chemical activities. At the same time, and alone among the technical services, the several theater Chemical Warfare Services reflected the administrative and organizational problems of elements whose primary mission was not active and whose concepts were not equally acceptable to all commanders. The CWS responsibility on the one hand took the form of providing a burdensome insurance, on the other hand of "selling" new kinds of combat support. The latter became the principal activity, and its success varied with the changing situations and different personalities involved.

The second portion of *Chemicals in Combat* deals with CWS troops and weapons in the field. World War II saw a number of significant combat developments in the CWS mission area. New smoke generators enabled large area screening methods to be applied to front-line tactical situations, turning CWS smoke generator units from rear area to combat troops. The 4.2-inch chemical mortar, developed for the accurate rapid-fire projection of toxic shells, won itself the new mission of firing high explosive ammunition in support of infantry. The change was not authorized until 1943, a decided disadvantage from the point of view of establishing doctrine and working out a mutual understanding with the troops supported. Despite this handicap, the chemical mortars and their mortar battalions had entrenched themselves in the hearts of the infantrymen before the war was over. The most controversial of the new weapons was flame. Only inadequate prototypes of flame throwers had seen action in World War I, and the reintroduction of flame with new portable and mechanized flame throwers in World War II was not accomplished without difficulty. Success for the weapons depended on mechanical adequacy, development of effective combat doctrine for its use, existence of suitable targets, and the confidence of the commanders and troops in the field. It was not often that a happy combination of all these factors could be achieved during the war. *Chemicals in Combat* studies in detail the little-known story of these CWS weapons and the units

*The Armed Forces Chemical Journal wishes to thank the *American Historical Review* for permission to quote the above extract from a review by Dr. H. Fabian Underhill of Indiana University.

that employed them on the battlefields of World War II.

Taken together, the three volumes of *The Chemical Warfare Service In World War II* can offer a broad and thorough insight into the place of the CWS in the war. Indexed and documented carefully enough to meet the scholar's needs, the work is none the less non-technical in style—accessible alike to the specialist and the general reader. Soldiers and civilians who participated in the CWS effort during World War II will be interested in this historical evaluation of their own performance and the performance of the CWS agencies and units, combat, administrative and service. Military tacticians, logisticians, and scientists will find much in these volumes which is pertinent to the present situation in the Armed Forces, and those who are presently working in the field of military chemistry may be surprised to find the origins of current programs in these World War II accounts.

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## DEFENSE CHEMISTRY

*(Continued from page 27)*

production, and sizes decided upon are two with 1 million gallon daily capacity and one producing 100,000 gal. per day.

Three other processes are being studied, these being based (1) on a reversed osmosis, (2) on electric regeneration of ion exchangers, and (3) on solar evaporation. Two other improvements are noted in the technical press: acoustic vibrations on a pipe inside evaporator tubes to create turbulence in the water film and improve heat transfer; and control of size and shape of ice crystals to reduce brine entrapment and give better crystal separation. (44) (45) (46)

References


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3) Chem. Eng. 4/18/60, p. 79
4) Off. Tech. Serv. 60-126, 5/6/60
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7) Off. Tech. Serv. 60-125, 5/6/60
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9) Chem. & Eng. News 5/9/60, p. 57
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18) Chem. & Eng. News 5/2/60, p. 43
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20) Chem. & Eng. News 5/23/60, p. 40
21) Chem. Eng. 5/2/60, p. 56
22) Chem. Eng. Prog. April 60, p. 54
23) Chem. & Eng. News 4/25/60, p. 33
24) Chem. & Eng. News 5/16/60, p. 50
25) Chem. & Eng. News 4/18/60, p. 108
26) Chem. & Eng. News 5/16/60, p. 67
27) Chem. Eng. 4/4/60, p. 60
28) Chem. Eng. 4/16/60, p. 110
29) Chem. & Eng. News 5/23/60, p. 51
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35) Chem. & Eng. News 5/9/60, p. 37
36) Chem. & Eng. News 5/2/60, p. 20
37) Chem. & Eng. News 5/23/60, p. 121
38) Chem. & Eng. News 5/9/60, p. 39
39) Chem. & Eng. News 4/11/60, p. 50
40) Chem. & Eng. News 5/9/60, p. 52
41) Chem. Eng. 5/2/60, p. 53
42) Chem. Week 5/14/60, p. 99
43) Chem. Week 4/2/60, p. 55
44) Chem. & Eng. News 4/25/60, p. 56
45) Chem. Week 5/28/60, p. 77
46) Chem. & Eng. News 5/2/60, p. 43


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## CHEMICAL CORPS TO PROVIDE

*(Continued from page 12)*

velopment and one field testing installation. After reviewing the problems stated in this document and determining your interest or capabilities in resolving certain of these problems, your organization may wish to contact one of these installations to obtain further information or to submit recommendations or suggestions for the resolution of these problems. R&D directions state that in so doing you may be assured that this Command will make every effort to protect your proprietary rights when submissions are made with this understanding.

In general the responsibilities of the various installations are as follows:

U.S. Army Biological Laboratories
Fort Detrick, Maryland
U.S. Army Chemical Research and Development Laboratories
Army Chemical Center
Edgewood, Maryland
U.S. Army Chemical Corps Proving Ground
Dugway, Utah

First, determine the R&D Command installation with responsibility for the problem of interest. Second, contact the Program Coordination Office of the responsible installation, and this office will cooperate with your organization in every possible way toward the solution of the problem.

The book is named—The U.S. Army R&D Problems Guide, Volume I, Chemical Corps.

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## TREATMENT OF GAS CASUALTIES

*(Continued from page 25)*

6. Painful sensation in the eyes

As soon as possible 2 mg of atropine (1 syrette) should be administered intramuscularly, through the clothing if necessary. Atropine, administered properly will counteract the lethal effects of three to five LD50s of the nerve gas, GB. For more severe exposure, atropine and artificial respiration will be required. The resuscitation can be carried out in an uncontaminated atmosphere by the mouth-to-mouth method or by use of mechanical resuscitators. The U.S. Army Chemical Warfare Laboratories has developed a safe, efficient mechanical resuscitator which delivers a controlled volume of air to the lungs. The U.S. Army Chemical Warfare Laboratories has also developed a mask-to-mask device for resuscitation in contaminated atmospheres, Figure 2. This device can also be used with mechanical resuscitators. Rescuers must take precautions against transfer of nerve gas from the victim. Contaminated clothing should be removed and the skin should be decontaminated.

**Figure 2**

*Continuation of Treatment*—Severe poisoning may require resuscitation for one to five hours and repeated administration of atropine. The adjunctive use of oximes can increase the antidotal value of atropine and reduce the period of artificial respiration. The oximes are used in "addition to" but not in "place of" atropine. Atropine may not stop the copious salivary and bronchial secretions and constant care is required to maintain a patent airway. Moreover, small doses of barbiturates might be needed if atropine fails to control convulsive seizures. Barbiturates should be used sparingly since they might add to the respiratory depression. Hospital personnel must guard against transfer of contamination and also against desorption of the poison from the clothing of the victim. This could impose a serious hazard indoors. The continuing direct care needed to maintain respiration would be a major medical problem in handling large numbers of casualties.

*SUMMARY*

Some of the medical problems associated with attack by chemical agents are shown in Table 10.

TABLE 10

*Some Medical Problems Associated with Attack by Chemical Agents*

| Agent | Medical Problems |
|---|---|
| Nerve Gas | Rapid effect<br>Mass casualties<br>Prolonged close surveillance<br>Prolonged resuscitation |
| Mustard Gas | Secondary contamination<br>Prolonged hospitalization<br>Secondary infection |
| Phosgene | Massive edema<br>Prolonged supply of oxygen<br>Secondary infection |
| Riot Control Agents | Rare problems of lung injury, or arsenical poisoning |
| New Agents | Recognition of psychotic persons. Rectification of injuries produced by same. Collection, control, and care of temporary blind, paralyzed or crazed. Provisions for unattended young, aged, sick, and infirm. Duty of quick medical countermeasures on widespread basis. |

## INDUSTRY LIST

*(Continued from page 4)*

BELL AIRCRAFT CORPORATION
Buffalo 5, N.Y.
John V. Robinson
Ralph Fawcett

BELL TELEPHONE LABS., INC.
Whippany, N.J.
R. O. Grisdale

BENDIX AVIATION CORP.
Detroit 2, Mich.
Winston E. Kock
Ralph D. Ormsby

BJORKSTEN RESEARCH LABS., INC.
Madison 1, Wisconsin
James E. Henning

BLAW-KNOX COMPANY
Washington, D.C.
Pittsburgh, Penna. (Cml. Plants Div.)
Edmund R. Bellows
Noel F. Boyd

BOEING AIRPLANE CO.
Aero Space Div.
Seattle, Wash.
Wichita, Kansas
Arthur J. Pilgrim
Robert J. Helzer
Robert N. Page
Joseph R. Galli

BOOZ-ALLEN APPLIED RESEARCH, INC.
Bethesda, Maryland
George H. Shortley
Robert P. Peterson

BORDON CHEMICAL CO.
Middlesex, N.J.
Louis J. Jaworski

BORG-WARNER CORP.
Roger C. Ingersol Research Center
Des Plaines, Illinois
Clarence E. Albertson
W. J. Rush

BRIDGEPORT BRASS CO.
Washington 5, D.C.
Alvin L. Mente, Jr.

BROTHERS CHEMICAL CO.
Orange, N.J.
Ezra Rosenbaum
Joel Rosenbaum

C-E-I-R, INCORPORATED
Arlington 2, Virginia
Jack Moshman
Harold E. Fassberg

CALLERY CHEMICAL CO.
Pittsburgh 37, Penna.
Richard A. Carpenter
Frank Waldo

CATALYST RESEARCH CORPORATION
Baltimore 9, Maryland
Richard W. McQuaid

CELANESE CORP. OF AMERICA
Washington 6, D.C.
Dr. Harold D. Medley

CHANCE VOUGHT AIRCRAFT
(Vought Aeronautics)
(Research Center)
Dallas, Texas
John N. Fischer
Leal Marvin Hurley
Russell O. Bowman

CHEMETRON CORPORATION
Chicago, Illinois
Edmund Dugan
Dr. John N. Pattison

CLEVELAND PNEUMATIC INDUSTRIES, INC.
Washington 6, D.C.
Edward J. Deslauriers

COLGATE-PALMOLIVE CO.
Jersey City, N.J.
Richard B. Wearn

COLUMBIA-SOUTHERN CHEMICAL CORP.
Pittsburgh, Penna.
F. G. Garrison

CONSOLIDATED ELECTRODYNAMICS CORP.
Pasadena, Calif.
Kenneth W. Gardiner

CONTAINER LABS., INC.
Washington 11, D.C.
Donald A. Thompson

CONTROLS FOR RADIATION
Cambridge, Mass.
Irving A. Berstein

COOK ELECTRIC CO. (Research Lab.)
Morton Grove, Illinois
Chester F. Bilinski

CORNELL AERONAUTICAL LABS.
Buffalo 21, N.Y.
Arthur D. O'Connor
Arthur Stein

CURTISS-WRIGHT CORP.
Woodridge, New Jersey
John E. Snow

DE BELL & RICHARDSON
Hazardville, Conn.
William J. Hakins

DEFENSE ELECTRONICS, INC.
Rockville, Maryland
Edward E. Swanson

DIAMOND ALKALI CO.
Painesville, Ohio
Thornton F. Holder
George F. Rugar

DOUGLAS AIRCRAFT CO.
Washington, D.C.
Eugene C. Kaliher
Richard B. Nielsen

DOW CHEMICAL COMPANY
Midland, Michigan
Leonard C. Chamberlain
Lewis R. Drake
Don D. Irish
Ira G. Morrison

DU-GOOD CHEMICAL LABS.
St. Louis 41, Missouri
Lincoln I. Diuguid

E. I. duPONT de NEMOURS & CO.
Wilmington, Del. (Biochemical Dept.)
Max T. Goebel
Henry S. Rothrock

EDO CORPORATION
Long Island (College Point), N.Y.
E. L. Cicero
Lawrence M. Swanson

ELGIN NATIONAL WATCH CO. (Micronics)
Elgin, Illinois
John W. Forss

EMERSON ELECTRIC OF ST. LOUIS
Washington 6, D.C.
Ralph V. O'Brien

ENGLEMAN & CO.
Washington 9, D.C.
Christian L. Engleman

ETHYL CORPORATION
Baton Rouge 1, Louisiana
William E. Burt
Hyman Shapiro

ESSO RESEARCH & ENGINEERING CO.
Linden, New Jersey
Fred W. Banes
Robert W. Kreks

EVANS RESEARCH & DEVELOPMENT CORP.
New York 17, N.Y.
Eric J. Hewitt

EXECUTIVE RESEARCH COUNCIL
Alexandria, Virginia
James A. Lafferty

EXPERIMENT INCORPORATED
Richmond 2, Virginia
Dr. Lloyd E. Line, Jr.
Dr. Ulysses V. Henderson, Jr.

FAIRCHILD CAMERS & INSTRUMENT CORP.
Syosset, Long Island, N.Y.
James E. LuValle

FAIRCHILD ENGINE & AIRPLANE CORP.
Aircraft & Missiles Div.
Hagerstown 10, Maryland
Chas. H. Hurkamp
John S. Attinello
Claude S. Huber
W. L. Long

FARRAND OPTICAL CO.
New York 70, N.Y.
Phillip Nolan

*(Continued on page 37)*

# WITH THE CHEMICAL CORPS

## SILLS TO ATTEND INDUSTRIAL COLLEGE

Norris E. Sills of the Office of the Chief Chemical Officer has been selected in Army-wide competition to attend the 1960-61 course of the Industrial College of the Armed Forces, located at Ft. McNair, Washington, D.C.

Sills becomes the fourth Chemical Corps civilian to be selected in the last six years to attend a senior service school. These are open only to outstanding military and civilian personnel who have demonstrated a potential for advancement to important command, staff and policy-making positions.

Sills is a graduate of the U.S. Naval Academy, Class of 1946. He holds a Bachelor of Science degree in Chemistry from Louisiana College, Pineville, La., and a Master of Science degree from Louisiana State University, Baton Rouge, La.

He joined the faculty of the Chemical Corps School, Fort McClellan, Alabama in 1953, and in 1957 was appointed nuclear physicist in the Office of the Chief Chemical Officer.

Previous appointees to the Industrial College have been Mr. Edgar A. Crumb, Executive Director of the Corps, Mr. Robert Bergseth, of the Chemical Corps R&D Command. Dr. Gordon Bushey of the Office of the Chief Chemical Officer recently completed the course at the National War College.

## RESEARCH CENTER NAMED IN HONOR OF DR. MILLS

Sonoco Products Company announced the construction of a research center to be dedicated in memory of Dr. James Edward Mills.

The new center will be located at Hartsville, South Carolina, where the Company manufactures paper products.

Dr. Mills, who died in 1950, was Sonoco's first chief chemist. He had a distinguished record with the Chemical Warfare Service.

He joined the Thirtieth Engineers (later the First Gas Regiment) at Camp American University in September 1917, as a Captain in the Engineer Reserve and was Engineer Officer of the Regiment in the American Expeditionary Forces in France. He was promoted to Major during the war and was a Lieutenant Colonel in the CWS Reserve when he retired after having served as Director of Research and Development at Edgewood Arsenal from 1921 to 1924 and Chief of the Chemical Division from 1924 to 1929.

Dr. Mills was Chairman of the Division of Chemistry and Chemical Technology of the National Research Council from 1929 to 1930. He was Chief Chemist of Sonoco Products Company, Hartsville, South Carolina, from 1934 to 1937 and a Director of Chemical Research from 1947 until his death in 1950. He was awarded the Herty Medal for Distinguished Contributions to Chemistry in the Southeast in 1944. He was a member of Phi Beta Kappa; Sigma Xi; American Chemical Society (50 years—Councilor of the South Carolina section from 1938-1947); South Carolina Academy of Science, President 1937; American Electro-Chemical Society; Society of Chemical Industry; American Institute of Chemists; Academy of Sciences; Fellow, American Association for Advancement of Science.

## COL. DELMORE PROMOTED TO BRIGADIER GENERAL

WASHINGTON, D.C.—Colonel Fred Joseph Delmore, Commander of the U.S. Army Chemical Corps Research and Development Command, Washington, D.C., was recently promoted to the grade of Brigadier General.

Born in Plains, Pa., in 1905, General Delmore holds a bachelor's degree from Scranton (Pa.) University and a master of science degree in chemistry from Holy Cross College, Worcester, Mass. His military schooling includes courses at the Chemical Corps School and the Command and General Staff School.

Though commissioned in 1931, he taught chemistry at Holy Cross College and Seton Hall College in South Orange, New Jersey, and worked for the Food and Drug Administration before coming to active duty in 1942.

During World War II and immediately following, General Delmore served in the Pacific Theater of Operations. His appointments in the Chemical Corps since World War II have included Deputy Post Commander at Army Chemical Center, Md.; Post Commander, U.S. Army Biological Warfare Laboratories, Fort Detrick, Frederick, Md.; Commanding Officer of the Chemical and Radiological Laboratories and President of the U.S. Army Chemical Corps Board, Army Chemical Center. In his present assignment he commands the agency re-

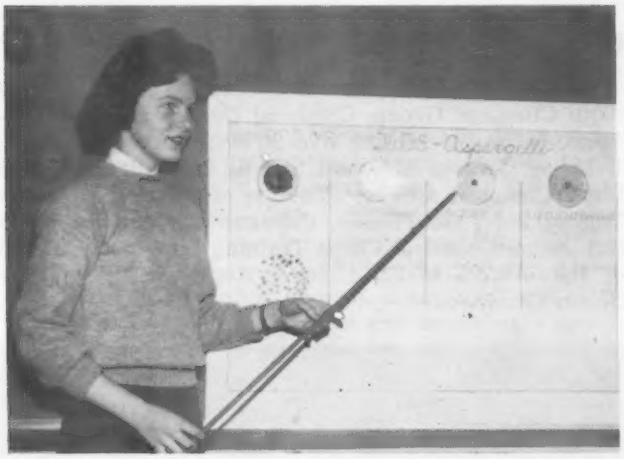
sponsible for formulation and execution of the chemical, biological and radiological research and development program of the Chemical Corps.

## COL. McHUGH'S DAUGHTER WINS HIGH SCHOOL SCIENCE PRIZE

EDGEWOOD, MD.—Competing with four others from Edgewood High School on biology projects, Nancy McHugh, a ninth grader, won second prize for her display of bread mold-aspergilli.

Nancy, 14, is the daughter of Colonel and Mrs. J. E. McHugh, stationed at the Army Chemical Center. She is taking advanced biology. To construct the display of bread molds and enter it in the fair was her own idea. The project took 55 hours.

Displayed on cardboard in petri dishes, are four types of bread molds. By each petri dish is a description and a microscopic drawing of each bread mold as seen through a microscope. Also the display tells how to prevent them.



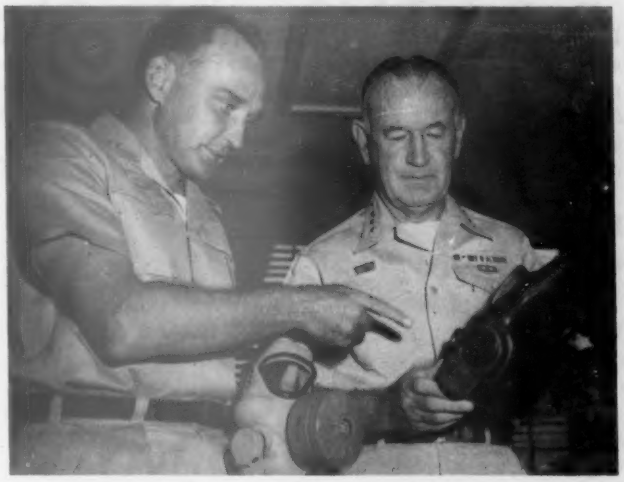
**SECOND PRIZE WINNER—Nancy McHugh, daughter of Colonel and Mrs. J. E. McHugh, Army Chemical Center, points out and describes her display of bread mold-aspergilli to her biology teacher, Mr. Moore, at Edgewood High School.**

## MAJOR NADOLA DECORATED

Major Santo J. Nadola (center), Post Engineer at Army Chemical Center, is presented the Army's Commendation with Metal Pendant by Brigadier General William E. R. Sullivan (left) while Mrs. Nadola

watches. Awarded the ribbon for service at Camp Drum, N.Y., Major Nadola recalls that when he was a 1st Lieutenant, General Sullivan, then a Lieutenant Colonel, had presented him the Bronze Star for meritorious service during the Second World War.

## U. S. ARMY PACIFIC COMMANDER INSPECTS NEW PROTECTIVE MASK



**New Mask unveiled in USARPAC—General I. D. White (right), Commander in Chief, U.S. Army, Pacific, looks over the new M-17 protective mask, the first to arrive in the U.S. Army Pacific Command, at his Fort Shafter Headquarters, April 4. Major Clyde L. Friar, Assistant Chemical Officer, Hq, U.S. Army, Pacific, also shows the old model M-9 A-1 gas mask.**

## LIEUT. GILBERT TAKES OATH OF OFFICE ADMINISTERED BY FATHER

Second Lieut. John C. Gilbert, recently commissioned in the Ordnance Corps, was administered the oath as officer, Regular Army, by his father, Colonel Harry C. Gilbert, Comptroller of the Army Chemical Corps.

Lieutenant Gilbert is currently attending the Field Artillery Officer's Basic Course at Fort Sill, Oklahoma, and serving his required two-year Combat Arms tour.

A former ROTC student, Lieutenant Gilbert was designated a distinguished military graduate upon his graduation from Johns Hopkins University in June 1958 with a bachelors degree in Mechanical Engineering.

## COL. JOSEPH C. PRENTICE ATTENDS NATIONAL STRATEGY CONFERENCE

DUGWAY PROVING GROUND, UTAH—Col. Joseph C. Prentice, Director CBR Weapons Orientation Course, attended a National Strategy Conference at Pacific Grove, California April 24-30.

The aim of the seminar, sponsored by Sixth Army, was stated as the promotion of public awareness and understanding of the conflict between the West and World Communism which must be faced in the next decade.

Community leaders from the eight western states were among the group of approximately 500 persons expected to attend.

The Army's Chief of Research and Development, Lieutenant General Arthur G. Trudeau addressed the seminar on "Implications of the Explosion of Technology." Another of the listed speakers was General Alfred M. Gruenther, President of the American Red Cross and former Supreme Allied Commander of Europe.

## ROCKY MOUNTAIN PROVIDES LABORATORY TEST SERVICES

Colonel William J. Allen, Jr., Commanding Officer, Rocky Mountain Arsenal, Denver, Colorado, initiated open house and inspection which marked the opening on 29 April 1960 of the remodelled and completely modernized RMA Chemical Testing Laboratory. Coffee and doughnuts were served and tours of the laboratory for Arsenal personnel were conducted by the laboratory staff throughout the day.

Rocky Mountain Arsenal now has one of the finest laboratory facilities of its kind in the entire area. It is dedicated to serve and support, as called upon, all Department of Defense activities in the region. Typical of the activities requesting laboratory services are the Utah General Depot, Ogden, Utah and the Marine Corps Depot, Barstow, California.

The laboratory now includes facilities for: inorganic qualitative and quantitative analysis; organic analysis; general metals testing; petroleum and petroleum products testing; testing paint and varnish and protective coatings; toxic agent testing; physical chemical testing; incendiary testing, and Metrology (calibration of gages and physical measurements).

In addition to the technical facilities there are offices, technical library, and a lunch room.

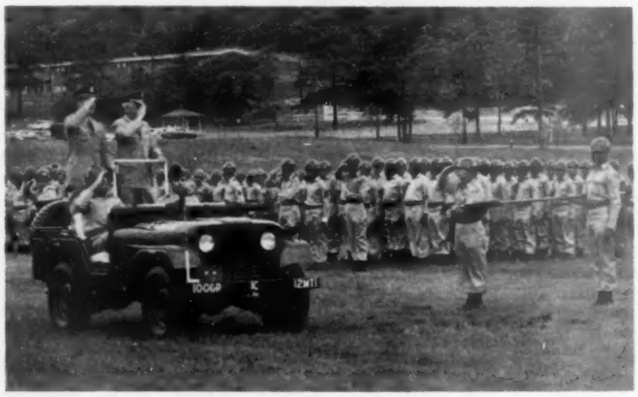
WASHINGTON, D.C.—Generals' ladies of the Chemical Corps greeted members and guests when the Chemical Corps Wives Club of Washington was hostess for the 2d Army Area Chemical Corps Wives at the April luncheon at Fort Myer, Va. Seated (left to right) are: Mrs. Marshall Stubbs, wife of Major General Stubbs; Mrs. Fred J. Delmore, wife of Brigadier General Delmore. Standing (left to right) Mrs. William E. R. Sullivan, wife of Brigadier General Sullivan; and Mrs. Graydon C. Essman, wife of Brigadier General Essman.

## GENERAL STUBBS VISITS USAREUR

HEIDELBERG—Maj. Gen. Marshall Stubbs (right), Chief Chemical Officer of the U.S. Army, is shown with Gen. C. D. Eddleman, USAREUR Commander, during his recent tour of Army chemical installations in Europe.

## CHEMICAL UNITS HONORED

FORT McCLELLAN, ALA.—Trooping the line of 100th Chemical Group, Chemical Corps Training Command, before presenting five STRAC superior awards, is Major General Marshall Stubbs, standing right, the Chief Chemical Officer. Standing with the General is Colonel John M. Palmer, Commanding Officer of the U.S. Army Chemical Corps Training Command. Seated in the vehicle is Lt. Colonel Roger W. Kemp, the Group Commander.



## SCHOOL TECH DIVISION CHIEF IS CRACK SHOT AND GUNSMITH

FORT McCLELLAN, ALA.—From the gunsmith's bench to the firing line Colonel George E. Danald knows his weapons; his knowledge has led the Chemical Corps School Pistol Team #2 to the competitive firing championship of the Chemical Corps Training Command.

Colonel Danald, chief of the Technical Division, U.S. Army Chemical Corps School, is an avid participant in competitive markmanship. At the age of ten, he fired his first weapon—an air rifle. A life member of the National Rifle Association, Colonel Danald has organized many shooting teams in various parts of the country and has also conducted matches for the Association. As

*(Continued on page 35)*

# INTERNATIONAL LUNCHEON AT ROCKY MOUNTAIN ARSENAL

Left to Right: Mrs. Wm. K. White, Mrs. R. C. Zalesky, Mrs. J. M. Chappell, Mrs. John F. Bohlender, Mrs. Walter Koch, Mrs. Stephen L. R. McNichols, Mrs. Wm. J. Allen, Jr., Mrs. A. W. Spigarelli.

The Rocky Mountain Arsenal Officers' Wives Club held a luncheon with an "International motif" at the Officers' Open Mess, Tuesday, 19 April 1960. There were nine tables, each decorated to represent a different country, and each presided over by hostesses who had lived in the country represented, and who gave a short descriptive talk about it. Typical desserts of each country were served. The hostesses and countries were:

Mrs. Raymond Hampton and Mrs. Paul Jones—Australia; Mrs. Lawrence Dellinger—Hawaii; Mrs. Leland Shannon—Trieste; Mrs. William Larkin, Mrs. Edward Scott and Mrs. Harry Kurth—Germany; Mrs. Watts Clark and Mrs. Americo Spigarelli—France; Mrs. Richard Baldwin and Mrs. Julio Seda-Rivera—Puerto Rico and Panama; Mrs. Artie Angelo and Mrs. Robert Arnberg—Japan; Mrs. J. R. LeRoy and Mrs. Kelly Paull—Alaska; Mrs. John Lund and Mrs. Albert H. Rock—Austria and England.

The honored guests at this unique affair were:

Mrs. Stephen L. R. McNichols, wife of the Governor of Colorado.

Mrs. Walter Koch, wife of the Civilian Aide to the Secretary of the Army for the State of Colorado.

Mrs. John F. Bohlender, wife of the Commanding General, Fitzsimmons Army Hospital.

Mrs. Joe Moffitt, wife of the Commanding General, Air National Guard.

Mrs. J. M. Chappell, wife of the Commanding General, Air Reserve Records Center.

Mrs. R. C. Zalesky, wife of the Commanding Officer, Colorado Military Sector.

Mrs. Wm. K. White, wife of the Senior Advisor, U.S. Marine Corps Training.

Some of the hostesses were wearing dresses from the foreign countries represented. A short business meeting and election of officers followed the luncheon.

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## COL. DANALD

*(Continued from page 34)*

an instructor for this organization, he is qualified to teach both rifle and pistol shooting.

Being a gunsmith, Colonel Danald reworks stock .45 cal. automatic pistols to increase their accuracy for competitive firing.

Shooting prowess does not stop with the male member of the Danald household. The colonel's wife was crowned Women's Illinois State Indoor Pistol Champion in 1957.

## SCHULTZ COMPLETES 39 YEARS

Mr. Charles D. Schultz, civilian employee of the Chemical Depot, U.S. Army, Hawaii, recently completed thirty-nine years of service as a government employee and was presented the 30-years service certificate by Lt. Col. John Moran, Depot Chemical Officer. Mr. Schultz began his employment at Edgewood Arsenal, Maryland in 1921. He transferred to the Hawaiian Area in 1925. Since that time Mr. Schultz

*(Continued on page 36)*

## SCHULTZ

*(Continued from page 35)*

has supervised the handling of thousands of tons of chemicals and chemical munitions including toxic war gases, incendiaries, smokes, and decontaminants.

He received the Meritorious Service Award shortly after the end of World War II for his outstanding services in the war effort, especially for his work in devising safer and more efficient methods of handling war gases and chemical munitions.

Mr. Schultz has assisted many Chemical Corps officers at one time or another and he is affectionately known to many who have been assigned to USARHAW as "Mr. Chemical Depot." Born in Washington Borough, Pennsylvania, he claims St. Petersburg, Florida as his home town. At present he resides with his wife at 1894 California Avenue, Wahiawa, Hawaii.

## ANNUAL MEETING

*(Continued from page 6)*

Chemical Corps is seeking the research potential of the member companies which belong to the Armed Forces Chemical Association.

The Chemical Corps is now in the throes of an expanding research and development program for the CBR defense of the United States. The Army desires that the Chemical Corps pursue the necessary research with private industry and scientific firms or institutions of learning.

Armed Forces Chemical Association, chartered as it is, with a primary service to national defense, is vitally concerned as the events begin to shape up about the time of this annual meeting.

## Relative Effects of CBR Weapons *

### Prepared by ACS Committee on Civil Defense

*Basic assumption: For the purposes of this table we agree that one B-52 bomber (or its equivalent) can carry either one 20-megaton thermonuclear bomb or enough CW or BW agent to create the comparable results shown in the upper half of this table.*

| | Nuclear Agents | Chemical Agents | Biological Agents |
|---|---|---|---|
| **Immediate effective area:** | **75–100 square miles (A & B rings)** | **100 square miles** | **34,000 square miles at the very least and with only 450 lb. of agent** |
| **Human lethality (or morbidity) in immediate area (unprotected):** | **98% (Lethality—A ring)** | **30% (not necessarily lethal)** | **25%–75% (Morbidity, not necessarily lethal)** |
| **Residual effect:** | **Six month fallout with an additional 1000 square miles of area** | **3–36 hours (nearly same area)** | **Possible epidemic or epizootic spread to other areas** |
| **Time for immediate effect:** | **Seconds** | **7½ seconds to 30 min.** | **A few days to 14 days** |
| **Real property damage, immediate area:** | **Destroyed (Nearly 36 square miles)** | **Undamaged** | **Undamaged** |
| **Variation in effect:** | **Little** | **Wide—need not kill, only incapacitate** | **Wide—need not kill, only incapacitate** |
| **Time an agressor is able to safely invade area after attack:** | **3–6 months** | **Immediate** | **Immediately after incubation period** |
| **Human protection that could be available:** | **Evacuation (?)<br>Shelters<br>Civilian mask (fallout)** | **Civilian mask, CD-V-805<br>Shelters with filters** | **Civilian mask, CD-V-805<br>Immunization<br>Shelters with filters** |
| **Current defense for U.S. population (physical devices):** | **Some, but can be greatly improved** | **Nearly nonexistent** | **Nearly nonexistent** |
| **Cost of protection:** | **Shelters ($150–$800/person)** | **Mask—$2.50–$8.00<br>Filters in shelters ($15–$20/person)** | **Mask—$2.50–$8.00<br>Filters in shelters ($15–$20/person)<br>Immunization (?)** |
| **Covert application:** | **Little** | **Some** | **Great** |
| **Detection and identification:** | **Simple** | **Complex but fairly effective and rapid** | **Difficult, complex, slow** |
| **Medical countermeasures:** | **Little** | **Good if immediate** | **Some, much more needed. High health and sanitation standards help** |
| **Would attack trigger retaliation?** | **Yes** | **Yes** | **Doubtful if covert, slow at most** |
| **Capital equipment costs to produce agents:** | **Very expensive** | **Somewhat expensive** | **Relatively inexpensive** |
| **How does agent attack target?** | **Direct impact, then some "seeking" with fallout** | **"Seeks" out target** | **"Seeks" out target** |

# DR. YORK SEEKS FULL KNOWLEDGE OF CHEMICAL WEAPON POTENTIALS

*By* RICHARD FRYKLUND

**(Reprinted by permission of the *Washington Evening Star*)**

The Pentagon's research chief wants more spending on chemical weapons—which he believes could be the ideal means of fighting limited wars.

Dr. Herbert F. York, director of defense research and engineering, said in an interview that research on chemical—and also germ—warfare should be stepped up until the full possibilities of these weapons are better known.

The Army has been promoting an expanded chemical and bacteriological warfare program for some time, but Dr. York is the first high Defense Department official to show similar interest. He is boss of research and development in the three services.

His opinions are the ones that count most when the Secretary of Defense makes his decisions.

**$44 Million Budgeted**

Dr. York pointed out that chemical and germ research already is enjoying a mild boom. The current budget provides $44 million for these activities, and that sum is being augmented by money from the emergency fund. The budget request for the coming fiscal year was $57 million, and Dr. York believes it should be—and and probably will be—augmented.

The rate of spending on chemical and germ warfare research has been about a tenth of that devoted to nuclear weapon research during the big years of A-weapon work, Dr. York said. He believes this is not enough.

"Our efforts to find out the full potential of chemical and biological weapons should be more similar to our efforts on nuclear research," Dr. York said.

Enthusiasts in the Army have touted chemical and germ weapons as substitutes for nuclear weapons in all types of war. Dr. York's principal interest, however, is in finding easily used chemical weapons for limited war.

**Speed Is Vital**

"A vital factor in a limited war is speed. If the invader can quickly present the world with a fait accompli, he has a better chance of getting away with it. At the same time the defender must act quickly to keep a small invasion from spreading and succeeding."

Perhaps an army using chemical weapons in a limited war could paralyze the enemy long enough to achieve swift victory, Dr. York suggests. There would be no damage, conceivably no deaths.

Some chemical and germ weapons could be distributed by air with great efficiency. Under some circumstances fewer aircraft would be needed to saturate a given area with chemicals or germs than would be needed to blast the area with nuclear weapons.

Compared with the cost in death, destruction and dollars of nuclear and TNT wars, chemical warfare could be relatively cheap. Also unlike nuclear warfare, Dr. York believes, it could be tailored to a small conflict—even a riot.

**Cites World Opinion**

Another advantage he sees is that chemical warfare could be more acceptable to world opinion than nuclear weapons. Tear gas—a chemical weapon—is conceded universally to be a reasonable weapon to use in putting down a civil disturbance. Similiar chemicals could be as acceptable as a defense in short-of-war uprisings the Communists engineer.

Dr. York is intrigued by the great variety of potential chemical weapons. He believes researchers have only begun to test the possibilities. Yet, already a wide spectrum of deadly and "harmless" mass and individual chemical weapons have been developed.

Army researchers have shown in the laboratory how one plane spreading gases could kill millions of persons, put them to sleep harmlessly, or simply change their personalities so that they cannot resist. Quantities could be tailored to small emergencies.

**Variety Is Advantage**

As this country is faced with a wide spectrum of potential war and near-war situations, the variety offered by chemical weapons is attractive to the Pentagon. Also, a bigger chemical arsenal would be in line with the Pentagon philosophy of a "mix" of weapons—that is possession of several types of weapons having the same general purpose, making it impossible for the enemy to concentrate on countering one.

Dr. York looks at chemical and germ weapons basically from a researcher's point of view. "I would like to find out what these weapons could do and then show the results to the military man and say, 'Pick out what would be useful to you.' At the same time there would have to be a civilian decision on the political desirability of adding more of these weapons."

The State Department says this country has never joined in any international agreement to ban chemical or germ weapons. The present policy is to be able to use them if necessary—for instance to use them if the enemy does.

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*(Continued from page 31)*

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